AN

ESSAY

ON

THE ORIGIN AND PROSPECTS

OF

MAN.

BY THOMAS HOPE.

IN THREE VOLUMES.

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ESSAY

ON THE

ORIGIN AND PROSPECTS OF MAN.

CHAPTER I.

INTRODUCTION.

I HAVE, in common with every other human being who has thought, wished my life here to be prolonged to a happier existence hereafter. Revelation has in me to mere hope added faith. Still have I sought to found my belief, not merely on the promises made through the medium of other men, who, like myself, might be deceived, or deceive, but on the unerring course of that nature which, when rightly viewed, admits of no deceit. The following pages are the result of my inquiry.

I advance in them nothing as an absolute certainty. That of which man may be actually certain amounts to very little. It amounts, at most, only to a few actually present sensations, called, some, of the sense, others, of the mind; and each, unto the minutest, detached and disconnected even from the nearest neighbouring

sensations;—such as sensations of mere time and space—of quantity and number—of touch, taste, smell, hearing, sight,—some in their intrinsic nature, and in their disposition relative to others resembling, others different from certain of the remainder;—some prior to, some following, certain others.

We assert certain facts which we cannot prove, and which we nevertheless regard as more undoubted even than others susceptible of proof. Such is the truism, that a whole is singly larger than are separately any of its lesser component parts. But, in so doing, we only yet use the word whole as already directly expressing the idea of a something greater than that other thing, which we only express by the word part. Consequently in advancing this position we only yet describe a mere peculiar mode of feeling or thinking itself. We draw not yet, from that peculiar mode of feeling or thinking, any later inference or conclusion. We state not yet any belief, in the mind only produced by taking of a peculiar idea a part, spontaneously connected with the rest, and connecting it equally with other ideas different from the former one, with which it was not immediately connected, in view only of the resemblance which in other respects these other ideas already bear to that former one.

All demonstration, even the most purely and

strictly mathematical, on the contrary, already is only a later statement, founded on two or more prior different and distinct enunciations of feelings or ideas entertained, each separately yet admitting of no demonstration, but to one of which we again, in view of the resemblance it already presents with the other, in our mind add other resemblances to that former one, only inferred from that former resemblance itself. In proportion as a demonstration only becomes founded on later inferences from such prior axioms or enunciations of positive primitive feelings or thoughts, distinct from each other, more numerous, more diverging, more distantly drawn, it must, from the character of an absolute, intrinsic, and self-evident certainty, in a greater measure pass over and degenerate into that of a mere surmise only of a something else, prior or posterior to itself.

Of many things at first sight appearing most evident we can in reality only entertain mere suppositions. That I am not, in this world, the only entity rational, or sentient, or tangible, or occupying a peculiar definite portion of space and time: that there exist around me myriads of other entities, sentient and tangible, distinct from myself: that of those other surrounding entities some resemble me more, and, like myself, feel, and think, and act in consequence of a will of their own, separate from mine, while others

do not: that besides other human beings, separate from, though similar to myself, there are brutes, vegetables, and bodies entirely inorganic and lifeless, on some of which the living ones tarry and move: that, of the various entities around me, many continue to exist even when I cease to feel or to perceive them: that many entities existed long before I felt or saw any, and that many others will only begin to exist after I have no longer the faculty to feel or to see them: that, besides those from which I can derive sensations, there are many others which exist, though I can derive from them no sensations: that, of the entities and modifications which I occasionally feel, and even of those which I never feel, some are nearer to, others more distant from the sensations and thoughts I derive from them than others: that of the modifications which precede and surround my sensations of them, and which through these sensations are known to me, some have with these sensations of them a connexion sufficiently close, permanent, and distinct from other modifications surrounding me at a greater distance, to be more peculiarly called component parts of my own individual aggregate and person; while of these modifications again others, not having with that person of mine a connexion equally distinct and close, can only be regarded as parts of other different surrounding entities and aggregates: that of

these latter entities and modifications, some nevertheless receive sensations and thoughts which, though separate from, and not directly perceived by my individual person, yet resemble my own sensations and thoughts in a greater or a less degree, and constitute the entities that receive them as more or less resembling myself; while of these latter entities and modifications others again receive no such sensations and thoughts at all, and thus only remain what are called mere inanimate beings, in certain respects more dissimilar from myself: that of the modifications which preceded my existence, my forms, my faculties, my sensations and my thoughts, some themselves produced certain of the others, even including certain of those of my own person; and that, of those subsequent to my formation, my birth, my sensations and my thoughts, which surround these, certain others again are themselves through the medium of these produced: that some are the causes, the parents; some again are the effects, the offspring of myself or of others from which they differ: that all relationship of cause and effect follows certain invariable rules: that there has been a past which is no longer, and that there will be a future which is not yet: that certain portions of time, of space, of quantity and of other modifications contained in these, are in reality contiguous to each other; while certain others of these are situated at a

distance in time and place smaller or greater from each other, and only through the medium of other intervening ones are connected together: that any external object, on which as I think I actually continue, during a certain portion of time, uninterruptedly to fix my eye, really, during that aggregate of different lesser portions of time, remains the same object: that the sun which I see rising this morning is the same sun which I saw setting yesterday evening: that it will again to-morrow rise and set: that my thoughts, my sensations—as well those which I call later internal recollections of former sensations from without, as those which I call actual present perceptions of external objects—do not this instant all arise for the first time: that my present being had a prior commencement, and may have a later sequel: that the ideas I entertain of an infancy, a childhood, and a youth which preceded my present mature age—the thoughts I still cherish of the many days I have seen, the many events I have witnessed, the many persons I have known and loved or loathed—of the parents I have wept for, of the wife I have worshipped, of the children I have lost or left—are not the mere fancies of the present moment, but the recollections of what once externally was, or the representations of what still externally is—are all so many different suppositions, none of which any longer amount to positive

certainties, and all of which can only, strictly speaking, be considered as mere beliefs, at the very best only founded on a presumed recurrence of certain successive combinations of sensations and ideas, representing certain external objects more frequently, and minutely, and connectedly, than do certain other sensations and ideas, in the external reality of the objects represented by which I thence do not equally believe;—and so many beliefs, during certain periods, and under certain circumstances of my life, not only while I slept, in my dreams, but while I was awake, and in a state of the utmost watchfulness, by me most firmly entertained, have at later times, and under different circumstances, again by me been so completely rejected, as the effects of mere illusions, errors, hallucinations, and deliria, only arisen within the precincts of my own individual mind, and without immediate external cause for them whatever, or without any other direct external cause for them besides the false reports of credulity, fraud, or fanaticism, or the false impressions, by juggling, phantasmagoria, ventriloquism, or other modes of deceit produced around me;—to my very face the entities I thought I had continued to fix—within my own hand the card which I fancied I had continued to grasp—have so often been, and in a manner so imperceptible to my utmost attention and vigilance, withdrawn or exchanged for some

other, in reality wholly different; of a limb already amputated men have so often imagined they still endured the agony; of so many facts, like the diurnal motion of the sun round the earth, by millions, during many ages most implicitly, on the evidence of their senses, believed, later ages have again brought forth a disbelief so firm and so general;—what I first, at a certain distance, and in a certain light, took to be a living, breathing person, has so often, on nearer inspection, and with a stronger light thrown upon it, proved to be a mere forgery in stone or on canvas, or a still more unsubstantial shadow; what, on first hearing it, I fancied to be a sound, by a person I beheld directly addressed to me, on minuter inspection has been so often so clearly proved to be a voice from some other different quarter, by one of those contrivances of art called ventriloquism, imperceptibly conveyed to my ears,—that I no longer presume to draw the line between what are direct impressions by entities or modifications existing withoutside my person made on my own sense and mind, and what are only later ideas and beliefs concerning such entities, in that very mind conceived: that I cannot feel any absolute mathematical certainty of any thing save the actual present sensations and thoughts I experience themselves: that I cannot be assured of the convictions which still cling to my mind, having, withoutside that mind,

a foundation more secure than those others once entertained, which since again have fallen away —have vanished: that I dare not trust that, like the beliefs once most firmly entertained, and since as unhesitatingly rejected, all those still most tenaciously retained will not some day, here or hereafter, also, like unsubstantial visions, be withdrawn from the mind.

Like images of external objects, during my sleep of a few minutes often most intensely believed to be perceptions of external realities, and producing the desires or aversions which such external realities alone can justify, but which, on my again awaking are, merely from their want of connexion with the sensations prior and posterior to that sleep more vivid and more connected, thence judged to be perceptions of external objects, subsequently presumed to have been only mere intervening creations of the mind, or dreams, why may not the sensations more vivid, more connected and more permanent, which return when I am roused from my nightly slumbers—which during the whole course of my present sublunary existence continue to cling to me, and to pass in my mind for impressions of external objects, after I have lapsed into, and again have resurged from, the deeper torpor of death, in their whole, from first to last, equally turn out to have been mere phantasms and dreams, only somewhat more congruous and

durable than those which, arisen during the sleep of a single night, are the very next morning already detected in their fallacy, but still as little founded as these on external realities?

From what I thus far call the realities of life, as from its dreams, I may at last awake to other later realities, or to other dreams more extensively and durably connected, of an entire different sort. I have no absolute certainty that any of the pictures, which at this moment present themselves to my mind, as internal recollections or representations of earlier sensations, first only derived from the impressions by external objects made on my sense and mind, really are the effects of such earlier and more distant impressions from without, already gone by, or that they really give a foretaste of other sensations and ideas which other impressions from external objects may, in periods still future and unexisting, here or hereafter, produce in us: I have no certainty that I have existed, felt, thought, willed, and acted during a certain measure of successive time; that I do not, in fact, at this present passing instant, only first begin to be, to feel, to think, to will, and to act; that all the days which I now fancy I have already seen, all the events which I imagine I have witnessed, all the relations and friends of which I think I retain a recollection, may not themselves be parts of a mere illusion or dream, only just beginning to take place, and

to glide over my mind. In his fits of insanity many a youth has, even while broad awake, fancied himself an old man, the relict of many successive centuries; many a beggar, a king, elevated to the throne by the acclamation of millions: I myself, during my sleep, have imagined myself in deep conversation with men, which, on awaking, I found never to have existed.

Perhaps when from the sleep of death, in which I expect to lapse on this globe, I again, in another different globe reawake to a new life, I may for the first time, in the vastness of space, discover a wonderful new machinery, of which my present grosser faculties of sense and of mind give me not the smallest foretaste or idea. From a new point of view, less indirect, less oblique —more central, more uninterrupted than any from which I at present can take a survey of the surrounding universe,—perhaps I may at a future period see new surrounding objects much more extended and varied than those I yet behold; or see the very same objects I already in part behold, in a way infinitely more minute, more explicit, more distinct and more connected than I at present do:—I may from a new and more internal situation in space, through new and more varied intervening media, for the first time in the surrounding world recognize modifications more early, more simple and more elementary than any as yet perceptible to my pre-

sent senses:—I may find the whole of space itself only to be a modification already later, more partial, and more complex of the modification of time:—I may recognise an earlier and more universal primitive material of both, of which certain remodifications, later and more partial, alone produce the difference of the perceptions I receive from the one and those I receive from the other:—I may then possibly, instead of believing, as I now do, that the future in its progress never leads back to the past—that this future ever impels us to a greater distance from each peculiar portion of the past—that there never can be, in the collective mass of time, as there constantly may be in that of space, a return to the points whence we first set out—a retrograde as well as an advancing movement—on the contrary find that in time, as we already do that in space, there exists with an advancing a retrograde movement; that through dint of a circle of a prodigious extent, of which on this present globe, in this present existence, we only describe a segment so minute as not to perceive its curve, and as only to make us fancy we still merely advance while we also in part again retrograde, we already by degrees again revert to the point whence the creation first started.

People are sometimes heard to exclaim, "Can I entirely disbelieve the evidence of my senses?" I answer, "Certainly not." If this is never

believed, nothing else can be so. But of how little do these senses, left to themselves, actually give direct evidence? How much is there, in our simplest and most familiar reasoning, which, though still only passing for arguments directly founded on the positive evidence of the sense, is already, in fact, an inference and conclusion only drawn from that evidence by the later operation of the mind? Only of a few detached sensations of feel, taste, smell, hearing and sight —whether they only pass for immediate effects of earlier impressions from more external objects, or whether they already pass for later and more internal mental recollections of such former sensations from without, and which in neither case give any intrinsic security for the external existence of the objects whence they are supposed to derive—do we, only while these actually last, receive direct evidence: and if, of the external facts which we deduce from the peculiar combination of certain of these sensations or ideas with certain others—from the order which certain of these hold in time and place relative to certain others—we cannot directly receive any such positive assurance, still less can we from any other different quarter derive any such;— still less can we from elsewhere derive a certainty of the existence of entities, more external or early than the sensations and ideas arising in our sense and mind, which cause, and

which are represented by these; or of the connexion of certain of these entities with certain of the others. Only of the external existence of certain of these entities and modifications, and of the connexion more proximate or more remote of certain of them with certain others, the sensation or thought, within the sensations and ideas more elementary and fundamental of mere time and space less or more frequently recurring in a similar order, occasions the belief less or more intense and rooted. By thinking that we have frequently experienced the arising of these different sensations and thoughts in the same peculiar relative disposition in time and place, we at last also come to think that they, or at least the external causes to which we attribute them, have a certain corresponding connexion with each other—a certain contiguity, out of which that of the sensations and thoughts itself proceeds.

When we think we actually feel, or hear, or see, outside the impression of our own person, that of some other positive person, distinct and separate from ourselves, we may in reality only outside ourselves see a partial imitation of the mere exterior of human forms and movements—a mere puppet, or picture, or shadow. Nay, we may, even when this puppet itself is already gone by,—when our own external sense already assures us that it no longer in reality stands be-

fore our eyes,—in our mind, through our recollections, still continue to view its impression so distinctly and forcibly as still to fancy it in sight. People, while broad awake, and still more when dreaming, often, from their mind, view outward even such objects for which they never beheld any external precedent whatever—which represent, to their knowledge, no external realities, past or present, of any sort. Often, even after a time, they mistake the very phantasms of their own mind, first conjured up intentionally as different from any sensations of external objects, for later recollections of sensations, previously by real external objects produced. They fancy that what had only first been put together in a certain way by the mere volition of that mind within, has previously been actually perceived by the sense without; and often, again, at a period still later, and when they begin to reflect more deeply, they again recognize the groundlessness of this belief; and again, by the mere effort of reason, and the palpable want of connexion between certain of their ideas, find out that if of these ideas some are the result of prior perceptions, received through the external sense, others, at first equally believed to be such, can, in reality, only have been internal visions of the mind. Often a jealous man has, for a time, fancied he saw in the arms of his wife the stranger, who at the time was in reality crossing the main; and

sometimes he has afterwards again inferred, that the person he first took for a stranger could only have been a relation legitimately embraced.

Descartes said, "Cogito, ergo sum." He might as well first have said, "Sentio, ergo sum;" but leaving out this minor criticism, if by the word "sum" he meant to express any thing more than that there is a certain series of thoughts, lasting a certain limited period of time:—if by that word "sum" he meant to signify that there moreover is, besides those actual more transient thoughts, the certainty of an entity more lasting than these thoughts themselves, in which inheres more permanently the faculty of receiving such thoughts, and which continues to exist for some time, as well when that faculty is not exerted, and when such thoughts do not actually arise, as when they do,—he certainly already transgressed the limits of positive certainty. Of these latter additional circumstances he could at most only entertain a strong belief, not receive an undeniable assurance. I have already shown that we do not know for certain whether we existed before we had any sensations or thoughts, or exist while these are suspended: that what we take for internal recollections of prior sensations from without, may be only present perceptions peculiarly modified. In strict logic Descartes was only warranted to say, "Cogito, ergo cogitationes sunt." I think; and consequently there exist thoughts;—there

exists a faculty of thinking, no matter whence derived, and by what entity, different from those actual thoughts themselves, this faculty be possessed.

D'Alembert, on the contrary, however, again went as much too far in the opposite extreme, when, in a letter to Frederic the great of Prussia, he asked, "Y a-t-il quelque chose?" and calls that a "terrible question." "Oui, sans doute il y a quelque chose, et cela d'averé, de certain." If there is nothing else, there are sensations, and there are thoughts; these are felt, and in so far at least they intrinsically exist, whether, and by whatever else, different from themselves, they may from without be produced, and from within be felt, and whether they represent any thing, outside themselves, or not.

Independent of our having, for the existence and for the connexion of external modifications, in their capacity as causing our sensations and thoughts, no other pledges than those sensations and thoughts themselves—than the belief in that existence which those sensations and thoughts themselves gradually produce,—the very beliefs in peculiar external modifications, which they produce, do not invariably at one time, and in one place, offer to our mind the same intensity and strength, which at another different time, and in another different place, they offer to that mind; or which, at the same time, they seem to

offer to other different beings, even which we fancy to possess an organization similar to our own.

While we have yet only experienced sensations few and slight;—while we yet only remain very young in this world,—we believe most implicitly in the external reality of certain events and entities, represented by our waking thoughts, or even dreams, which, at a later period, and when further experience and observation have made us believe more intensely certain other circumstances, which appear to us incompatible with these former ones, and of a nature, when credited, to overturn and to render proportionably incredible their prior testimony, we again as firmly and strenuously disbelieve. Nay, while the mind, still young, yielding, and unfortified against beliefs only conceived on slight grounds by other beliefs resting on foundations more firm and solid, and which, if inculcated first and in good time, would, by the depth and spread of their roots, themselves utterly have repelled and excluded the penetration of those that happened to precede them, is already pre-occupied by those weaker ones, before those fitted to acquire more strength can win their way, they will themselves, on the contrary, prevent those susceptible of taking stronger hold on the mind from striking root in the same; they will employ that very faculty called reason,—which may be rendered conducible equally, according as it is directed in

the right way or the wrong, to the establishment of truth, or to that of falsehood,—to build round the latter a niche protecting it from disclosure by the former, instead of wresting from its face the veil by which its fallacies are hidden: and not only such men as are ignorant and ill-judging on all subjects alike, but even such other men as, on topics not directly interfering with certain prejudices imbibed most early, and rooted most deeply, on which they have only later turned the whole strength of their more matured mind, evince the utmost penetration, and display the utmost sagacity, will, on certain other topics, respecting which early in life, and before their reason began to ripen, they have been accustomed to view one side of the question only, and have never had their eyes opened to the arguments offered on the opposite side, reason most feebly and falsely. How often are the beliefs which we ourselves at a peculiar period, and under peculiar circumstances, entertained on a peculiar subject, wholly at variance with, and again rooted out by those which, on the same subject, we adopt at another different period, and under other different circumstances!

It is no uncommon thing to see the same person, when taken by surprise, and before he has had leisure to reflect, by his words and actions indicate a fear of certain things, of which, with more opportunity to consult his reason, he would

have rejected the possibility. How often we behold a man in his infancy, and before his judgment is formed, imbued with ideas of ghosts and hobgoblins, and at more advanced age, in the day-time, and when surrounded by other entities, alive and breathing like himself, proof against a belief in beings immaterial, and yet producing in others impressions similar to those produced by matter, at night, and when alone and in the dark, relapsing in his former fears, and by any sudden sound or vision made to fancy he beholds a spectre! How many individuals have we heard of, who, in perfect health and full possession of all their mental faculties, only give credence to the suggestions of a reason sound, sober, and judicious; and who, at the point of death, and with an intellect enfeebled by disease, become a prey to the grossest or most puerile superstition, submit to the most absurd mummeries and practices, and, after living like philosophers, die like mere capuchins!

While, on the one hand, we believe certain assertions on the slightest grounds, as long as we have not, for withholding from them our credence, reasons more cogent than we have for giving the same; on the other hand, we, even with motives very weighty for yielding to other opinions our belief, suspend, or refuse, or even again withdraw the faith by them demanded, when we are made to discover other new cir-

cumstances, still more weighty than the former ones, which invalidate their evidence.

Thus the diurnal motion of the sun round our earth, for which, as long as we continue tenants of this smaller globe, itself revolving round that sun, we possess what may be considered as the fullest evidence of the mere external sense, we nevertheless no longer believe; but, on the contrary, from an accumulation of inferences more deep and far-fetched of the mind, which controvert that single impression of the sense, and indicate the very reverse of what it at first sight announces, as fully and firmly disbelieve. As a man who first undertakes to prove a peculiar assertion, only tries to do so by producing later inferences deduced from former direct impressions on the sense, so a man who afterwards again undertakes to disprove the peculiar assertion maintained by the former, again only tries to do so by adducing for the existence of other and different phenomena, with the existence of which that of the former phenomena appears incompatible, other proofs, other inferences, still more weighty, and more substantial, which again exclude or subvert those tenets that, as long as unattacked, stood their ground, and were admitted as tenable.

We should thus, if we resolved never to admit in our mind the least faith respecting aught but absolute certainties, never think. We should, if we had no hopes of persuading others to a

belief in any thing, save such as we ourselves had a certainty of, never converse with other men. If they have senses and minds constituted like our own, they must already, without any communication with our sense and mind, be sufficiently certain of all the things of which we ourselves can obtain a positive assurance, to render that communication superfluous; and cannot, through any medium of ours, acquire a certainty of what we ourselves only surmise. If, on the contrary, they have senses and minds differently constituted from ours, we cannot understand each other at all—cannot reason together on any topic whatsoever. All reasoning only consists in causing actual detached sensations from without to produce inferences and to cause combinations within; of which, only because those formed in certain minds may be made to subdue or to yield to those formed in other different minds, the communication between those different minds, may have its use. If we were determined only to act on positive certainties, we should never address any surrounding entities with the intention to render them, by our arguments, amenable to our interests, or by our actions, subservient to our views; for, as I observed before, we can have no certainty even of the existence of such entities, or the accomplishment of such views. We should not even act or move for the mere direct

solace or convenience of our own persons, uncertain as we are whether we possess any permanent bodies, or any bodies at all. We should, by our own choice only, like Indian idols, remain seated immoveably where we happen to be placed, unassured as we must remain whether any change of position will afford an improvement in our condition; and let unforeseen and involuntary impulses alone determine our future fate and circumstances.

But unpossessed as I must content myself with remaining of a certainty, my sensations and thoughts nevertheless inspire me with the strong belief that there exist around me other entities and modifications distinct from myself; that of these other entities and modifications some resemble me more, and themselves receive from without sensations and thoughts like those which I receive, while others resemble me less, and receive no sensations or thoughts similar to those which I receive; that of these entities and modifications withoutside my sensations and thoughts, some themselves produce others, and produce these according to invariable rules; that I can communicate certain of my thoughts to other men, and can in my turn receive communication of the thoughts arising in other men; that through the communication of those thoughts, given and received, certain men may influence the thoughts and actions of other men;

that as these thoughts are representations, less or more true and faithful, of external objects, they influence men less or more to the advantage of their own individuals and of society at large; that by a sedulous study and an increasing cognizance of the invariable course of nature we become more able to discriminate what are actions of a salutary tendency, from what are actions of a detrimental sort; more inclined to prefer those of the latter to those of the former species, and thereby—imperfect as must, to the last, remain all information on a globe from which we cannot yet embrace the whole of the rules which guide the universe—more likely to advance our own individual welfare, and that of other distinct surrounding individuals with which we are connected.

With the view of acquiring this knowledge in as far as I could, I have long exerted my utmost powers of observation, of thought, of digesting the facts I collected; and with the view of disseminating to my own advantage and that of others,—for the increase of my own felicity and that of my fellow-creatures,—the fruits of my study, I now write.

Such being my motives for committing my ideas to paper, the consequences must evidently be twofold: firstly, that the opinions I profess are sincere; and next, that they are the result only of a long and severe scrutiny. What-

ever system I might already, through dint of much labour, have reared (for whoever writes, and confines not his theme to mere insulated facts, without drawing from them any inferences, rears or confirms a system), has again been unhesitatingly sacrificed to the love of truth, the moment that truth seemed to lean on the side of another system, opposite to the former, more probable and better founded. Even when I had, as I thought, attained the very conclusion of my arduous task, if some new light arose and was reflected back on the parts more early and more fundamental of my theory, so as to give them a new and a different aspect, I have retraced all my steps, retrograded till I again reached the doubtful point, pulled asunder piece by piece the whole superstructed fabric, and, with the new materials added or substituted to the former, remodelled my entire work anew. Thus I have, more than once, drawn ultimate conclusions wholly opposite to those which I had previously expected to establish.

Vast and far apart as are the outermost opposite limits of my theme, nowhere have I, in treating its intermediate details, to my knowledge, taken a bold leap in order more rapidly to compass its end; nowhere have I, intentionally, skipped over any intervening difficulties, in order the sooner and the more surely to arrive at a con-

clusion settled beforehand. I have cut asunder no knots which with greater patience I might have hoped to untie. A slow and shortsighted mole, creeping underground in the dark, as is each human being, when engaged in the contemplation of objects so high and distant as those here submitted to the reader, I have been content with groping my way, as I was fitted to do, earth to earth. From each truth which I fancied I had mastered, I have advanced the next step only with the utmost caution. When I found myself inextricably arrested in my progress in one direction, I have wriggled round, or turned back, till I found, in another different direction, more to the right or left, another path more circuitous, but more wide, through which I could perceive and pursue the light.

Ever continuing, in common with all other things created, to move on in space with that intangible point in time called the present, from a past already gone by, to a future not yet come; ever only able from the fleeting perceptions of that fugitive and unfixable present, to infer the past, and from that past, in its turn, to conjecture the future, I have yet dared, from the small number of events simultaneously and successively experienced by my diminutive self, to draw inferences respecting surrounding things, as remote, one way, as the first creation of matter,

and the other, as the final destination of man. If I have dared too much, my work itself will condemn me.

With respect to the details of the physical phenomena of which I have occasion to speak, I may frequently advance erroneous statements. I am not myself much of what is called an experimentalist. I can call myself a natural historian no further than every man who, without the help of alembics and crucibles, electric batteries and Voltaic piles, telescopes and magnifiers, by his mere unassisted senses and mind, athwart the later and more partial phenomena of matter searches for its earlier and simpler principles, is entitled to that denomination. Indeed, apprehensive lest an investigation too minute and too protracted of certain branches of what is called natural science, might render my eye both external and internal,—both bodily and mental,—too microscopic and too intent on penetrating the earliest stages of modifications merely physical, to retain leisure, means, and long-sightedness sufficient for spanning at the same time their later mental developments in such a way as to compass the whole aggregate of created matter, I have even studiously resisted the temptation to enter deeply into mere mathematical and physical researches, and have chiefly borrowed my account of such from the experiments made by others, which seemed to be best founded, and

most consistent with each other and with the results of my own observations.

With regard to the internal faculties and phenomena called, collectively, of the mind, contained in that later laboratory of sensation and thought yclept the brain, of which each human being well constituted carries about with him a complete specimen—though no man can, of any of its parts, immediately with the peculiar form and structure identify the peculiar faculties and movements, because the former can only be laid open to the light by operations which destroy the latter,—I have, for the opinion I enounce of their mode of existence and development, entirely and solely trusted to my own observations and inductions. I have endeavoured to understand the nature of the mind, not by turning my outward senses on objects still further outward, but by turning the later and more internal faculties and impressions of my mind outward upon the earlier and simpler faculties and phenomena of that mind itself; by watching its earlier and more external processes through its later and more inward operations. I have, perhaps vainly, said, "I want not from elsewhere: I possess within myself all the materials necessary for studying all the faculties and movements of the mind."

Of the things which I describe, many may, each singly and separately, already have been

described before much more fully and circumstantially than I durst think of attempting; others, on the contrary, have not yet, as far as I know, been touched upon at all; or, at least, have not yet been placed in that intimate connexion with the former ones in which their external prototypes really stand, and in which I have endeavoured to collocate, relative to each other, their descriptions. My chief aim has been, while only pointing out more slightly the peculiarities of a more late and superficial sort, in which certain modifications of matter and of mind differed from certain others, to dwell more sedulously on those attributes more elementary, and fundamental, and primitive, in which those very things that in certain conditions more partial and more superstructed, again present greater differences from certain others, at bottom, and in their earlier shape still more resembled those others, and remained of the same genus with them; to fix the eye more on the unbroken connexion between the different parts of the universe of matter and of mind, than on the distinction of certain of these parts from others; and, by diving one way somewhat deeper than I think has yet been done into the origin of things created, and, by penetrating the other way somewhat further than has yet been attempted into their furthest yet unborn consequences and developments, to display somewhat more exten-

sively than has yet been attempted the relationships that really exist between all the different external objects more proximate or more remote of our feelings and of our thoughts; between those productions of the great primitive cause of all known effects that are earlier and those that are later; between those that are nearer to and those that become more distant from that first cause itself; between the past, the present, and the future, unto their furthest limits.

For this endeavour alone I claim some credit. Of whatever subject the history is first traced to its earliest source in time past, and thence is carried forward, in most unbroken continuation, through all its successive ramifications, to its utmost probable issue in time to come, the account, however slight, but resting on just and well-founded inductions, may singly, in science, cause greater advances than will do thousands of descriptions of different things, each individually most minute—most laborious,—but each desultory—each devoid of that connexion with the rest which their external subjects in reality bear to each other. What then must, in good hands, be even a connected sketch only of the general concatenation of cause and effect, both in the physical and intellectual world?

I may be thought presumptuous in attempting to give even a mere approximation to such—may

be laughed at for hoping to succeed: but no one can succeed in any thing who does not try; and in my case, where nothing more urgent can be sacrificed in the attempt, the probability of success may be made to preponderate over the chance of failure, and the fear of ridicule. Nothing great is undertaken where that fear predominates;—where we dread a weapon formidable only when fled from, and falling innoxious when boldly faced.

A work in which all the leading conditions both of matter and of mind, as yet known, are necessarily, in some degree, made successively to pass in review, must needs contain much which as yet only is an approximation to the full and exact truth. Many of the less important assertions, which in themselves, as far as they go, are just, must still from other assertions, with which their subjects are in reality connected, remain separated by intervening chasms of thus far insuperable ignorance, or only with these others be connected by false and erroneous statements. Innumerable must be the omissions of essential points of information, and the intermixture of errors with truths. But if of the few new facts upon which I cannot help thinking I have alighted, or even of the few new connexions between facts long established, which I imagine I have discovered, any be thought of the least importance, and serve to give additional perspi-

cuity to our ideas or confirmation of the external realities they represent,—and still more, if they serve to increase our disposition to what is good, and our aversion to what is evil, by increasing our confidence in the rewards attendant on the former, and the penalties arising out of the latter,—let not any errors, however palpable to others, which still may have clung to my essay, in the eyes of the reader acquire a magnitude so exaggerated as to render them indifferent to the adoption or rejection of my theory.

If we wish to extend our knowledge, we cannot confine ourselves to the investigation of the things that fall immediately under the cognizance of the sense: we must conjecture; we must abstract; we must generalise;—and in generalising we must always, from what we know for certain, launch into what we only believe,—what thus remains liable to error. But should certain of my conclusions be of a nature calculated to combat and to overturn certain other even of my own inductions, in a manner more triumphant than has yet been done, even this would already be a new step advanced in science.

Many men have complained, that the deeper they dived in the depths of metaphysics, the more they became, instead of enlightened and made to see their way before them, on the contrary only bewildered—only involved in a mass

of darkness, confusion and contradiction deeper and more dense. This cannot have arisen from the intrinsic nature of the modifications themselves to which they sought the clue. Nature has followed in her developments not only of matter but of mind fixed and invariable rules: nay, where she has permitted us first to begin perceiving their series, she has allowed us to go on unfolding their later combinations in a regular progression. The first attributes of matter are already phenomena only appreciated by the faculties of the mind, as the last combinations of the mind only rest on the first conditions of matter. Of the uncertainties so often incidental to—of the errors so often mixed with—metaphysical pursuits, the fault must thus have lain, not in the subject itself, but in the wrong method of conducting the inquiry; in a predetermination at the very outset of this latter to establish certain preconceived opinions, where the later conclusions drawn ought only have been left to flow naturally out of earlier premises spontaneously occurring;—in a manifest partiality felt for collecting only such observations as seem to favour and to support a peculiar doctrine, rather than a disposition cherished to investigate with equal eagerness and zeal whatever circumstances may make for or against our peculiar belief.

Instead of pursuing this latter fallacious mode of discovering the truth, most inimical to its real

detection, men should first only seek to lay down just principles, and then let the later conclusions fit on to these spontaneously in the best way they could.

This is what I have at least strived to do. I have tried to discard all preconceived opinions. I have cleared away right and left all later, more partial and more superstructed attributes not only of mind but even of matter, till athwart these latter I penetrated to the earliest, simplest, and most general positive conditions which I could find; and after I had alighted on these, I have on their deep and broad base replaced my later and more partial materials, both corporeal only and intellectual, according as on all sides and in all directions they seemed to tally with these more perfectly. Thus I have at last, by insensible degrees and transitions both analytical and synthetical, arrived at the conclusions which I here present.

I thus cannot join in the general charge brought against metaphysical pursuits, that they only retain those unfortunate beings, allured by them, in an inextricable maze or circle;—that they lead to no final result, or at least to none that is useful in practice. The earlier and simpler phenomena of a purely physical sort have themselves pointed out to me the way to the later ones of an intellectual nature, and these latter have in their turn thrown fresh light over the former.

At a period when, if the study of the phenomena which appertain to the moral world are generally neglected, those, on the contrary, that set forth the mere physical properties of matter are pursued with the utmost activity;—when while with regard to the former there seems to reign the utmost indifference, with regard to the latter every day teems with fresh discoveries, I might, no doubt, by delaying the publication of my work, contribute greatly to the further improvement at least of its earlier and more elementary parts; but science is long and life is short. I have already during the best period of my existence, not only sacrificed social enjoyment to recluse studies, but, moreover, in doing so, greatly impaired my health, and thus lessened my chance of a prolonged existence. I may thus with reason apprehend that by trying to do much better than I have thus far done—by delaying for that purpose much longer to communicate the fruits of my labours—my days may come to an end before my task is completed. I therefore prefer publishing what still remains full of flaws and imperfections, to what, more elaborately finished, might only be doomed to follow me to the grave. Others, beginning from where I have been forced to leave off may, partly supported by the very scaffolding I have helped to raise, complete and beautify the monument of which I set out the rude beginnings. They will with less intel-

lectual labour be able to correct my errors, to supply my omissions, to cement my disunited assertions, to smooth my asperities, and to make my statements glide into each other with more ease and more perspicuity. Thus giving the finishing touch to what I have only vaguely sketched out, they will reap the praise bestowed on the edifice of which I have collected the materials and conceived the plan. So be it! My object is the further dissemination of knowledge and of happiness; and whether I myself, or others, gain the applause merited by pointing out a speedier or surer way to its attainment, seems, so the end be attained, a matter of indifference. I must equally be the gainer by the result.

Whenever I have, in my way to the elucidation of what I deemed valuable truths, met with such errors as seemed calculated to impede their establishment, I have always made the exposure of these errors, by showing their incompatibility with truths already acknowledged, the first part of my double task; and made the announcement of the new truths intended to be inculcated, the second. Errors, where they exist in the mind, must be removed, ere sufficient room can be cleared out to rear in their stead the new and more extensive truths, of which they hindered the admission.

Great names I have always mentioned with

due respect, even where I questioned the doctrines ushered in, or maintained, under their sanction. Wherever, as must frequently be the case, I myself mistake the wrong for the right, I shall ever be ready to acknowledge the trouble taken to expose the fallacy of my reasoning as an obligation, provided the task be undertaken from the same motive from which I wrote: the love of that truth, whose empire must equally be extended, whether I inlist others, or whether others inlist me, under its legitimate banners.

Even where I owe most to prior authors, I have seldom indulged in the pleasure of quoting their works: not that I wished to appropriate to myself any of their discoveries. Those, in whose minds have originated great advances in science, are generally too well known to hazard the attempt, even if I had been inclined to boast of borrowed feathers: and to have, at every step of my progress, repeated their illustrious names, could only have increased the bulk of my work, without adequately increasing its utility. Moreover I must have been prevented by the very mechanism of my essay. The facts I have borrowed from different preceding authors are so intimately interwoven and blended with each other and with my own conjectures, that, to have given each man his separate due would have been as impracticable as it was unnecessary to my purpose. The different origin of different

lights, from different quarters diffused over a subject, can only be pointed out while they remain distinct and partial: its trace must cease to be visible where they merge in an universal glare; and the time perhaps may come, when all men will have to renounce individual and separate merit.

As the title of my work indicates, its main object is to trace the origin, the vicissitudes, and the final destination of man; but the very globe on which man first arises, is not a distinct and separate whole. It is only a late, a small, a remote part of an universe of things created, comprehending millions of other globes earlier and larger than our mole-hill, to many of which it is only a mite, and to some of which it owes its own later existence, and that of all the entities of which it becomes gradually composed; nay, to all of which it remains to a certain degree subservient; in so much that we can only of the origin and prospects of the entities that arise on its surface form a sound judgment, by casting our glance constantly both forward and backward on all the other globes by which we are surrounded.

Whoever has attempted to write, even only on later and more partial objects of the creation separately, and has wished to describe their appearance from their first beginning, must already have experienced the difficulty not merely of

saying all that essentially pertained to the subject, but of saying only that, and of saying of it every lesser part precisely in that peculiar stage of his progress—in that peculiar order with regard to the remainder—where it was best calculated to prepare one for all the assertions that were to follow, and to confirm all those that preceded; where with the least repetition and redundance might be combined the greatest precision, perspicuity and connexion. How absolutely impossible then must necessarily be this most seasonable timing of every different detail, where the whole aims at embracing a description of all the most essential attributes both of matter and of mind, each, from their earliest known beginnings carried on to their utmost ramifications yet discovered by us.

All descriptions given by man must, from the very essence of the materials of which they must be composed, and of the means by which they must be communicated—namely, by words addressed to the ear or eye—necessarily be liable to certain defects, or, at least, discrepancies from the originals described, which no human ingenuity can avoid, and for which the reader should be prepared, in order when they occur to make allowance.

In didactic works, professing to describe many external entities and modifications which, in reality, begin to exist simultaneously, or, at

most, at short distances from each other, and go on being developed together, the descriptions can only be presented successively, so that of each different modification in particular the account, as it is intrinsically given with greater precision and accuracy, must be farther removed from, and placed at a greater distance before or after that of the other modifications different from itself, to which its original lies closest.

Thus while of an entity called animated, the parts termed vital in reality have their commencement soon followed by that of their parts named sensitive, and these again, soon followed by that of their organs termed cerebral or intellectual, each superstructed on the former ones, man, in proportion as he wishes of each of those parts individually to render the description more explicit, is obliged, however small be the period of real successive time which the commencement of these different developments occupies, and however simultaneously they all go on, to stretch out that description to a greater successive length, and more in that description to separate the account of each part individually from that of every other part really nearest to it in time and place: and the greater the number and the difference of external objects described, the greater becomes this discrepancy between the originals and the representation.

This is a defect inherent in the very nature

of all description, even the best; and becomes more obvious, as the description is, in other respects, rendered more accurate and more detailed. Infinite are the other faults which result only from the individual capacities and means of the describer,—from want of sufficient materials on which to found his observations, or time allowed him to digest these thoroughly. Had I only been able to command all the leisure, required for that purpose in a work like mine, how many errors that subsist might have been removed!

The imitative order and connexion of the different parts of my description, such as it may be, is however, I flatter myself, sufficiently analogous to the real concatenation of the object described, to enable such as should have no taste or leisure for tracing step by step each peculiar branch of my long and manifold investigation, to skip over those parts by which they are less attracted, and proceed at once to those which more excite their curiosity; provided only that they consent to take for granted the conclusions I draw from earlier inferences which they have not taken the trouble to investigate.

Desirous of giving to the long chain of arguments which I sometimes string together the utmost perspicuity, I have been obliged to waive in my style all attempt at elegance, without having dared to seek conciseness. My diction is necessarily always monotonous, often trailing,

and sometimes, I fear, even pedantic. For these faults the uniformity and simplicity of the principles on which my work rests must account, and the importance of the result must atone. Eloquence is produced by presenting contrasts; my aim has been to render similarities more evident.

Often indeed will my style incur very serious blame. Often, from the number of thoughts so connected together as scarcely to bear being presented in sentences wholly separate from each other, it will seem so involved as to require in the reader the most unremitting attention not to lose the thread of the subject; but whoever undertakes to describe not only what attributes a number of different things intrinsically possess, but moreover, and in the same breath, what other attributes of other objects, earlier or later and more distant than their own, these are, in their turn, again connected with;—to present to the mind of the reader not only the picture of what each object singly is, but, at the same time, the constant image of what else it is superstructed upon, and what else it produces—will often be unable to avoid this circumstance, which only to intellects limited and able to retain very little without reposing from their labours, like those of man, is a positive defect. In an essay of the nature of mine, the understanding of the reader must necessarily on its side make some effort and advance a few steps, so as to meet the ideas of the

author half way, instead of remaining quiet and unexerted, while the unfortunate writer alone is required to perform the whole of the strides necessary to reach the reader's capacity. This mutual advance the very nature of the subject renders indispensable.

Words are but arbitrary and conventional signs, framed by man to represent the objects of external nature, or the ideas by these objects in man produced: and as my chief purpose is, to mark the many still unheeded connexions that exist between certain of the more important modifications of matter and of mind which themselves intrinsically have already long been rendered familiar topics of discourse, rather than for the first time to describe lesser and more partial objects and modifications, thus far still remaining wholly unnoticed and undescribed, I shall seldom want words wholly new, even to represent what may be new in my mode of combining ideas already frequently expressed. This will be accomplished by connecting certain already familiar expressions together in a new way, more than by creating thus far uninvented and unheard-of new terms.

When I have trod on entire new ground, I have boldly created new words. I have never displaced any expression, already received and in use, from the meaning to which it had been generally attached, in order to transfer it to a

new signification, even where in its former sense it already had a sufficient number of synonymes, to appear a piece of superfluous wealth. The contrary practice I have ever thought conducive only to unsettle both our ideas and our language. Little mischief can arise only from overabundance of expressions, much from ambiguity. Of any word, by abusive application again become vague and uncertain in its meaning, I have always given a definition ere I hazarded the use.

Among words of this sort are those which, like that of immensity, of incomprehensibility, of infinity, of indivisibility, of immutability and of innumerability, express the absence or negation of certain positive attributes so radically inherent in all modifications alike of matter and of mind such as our faculties of sense and of intellect can discern, that where we deny them in an absolute and unconditional manner, we must at the same time imply the absolute absence of all modifications of matter and mind, such as we know, whatever; and therefore can, where we deny them in such an absolute and unconditional matter, and yet speak as of any thing that is, only be understood to speak of the sole entity which must be independent of them, and yet be, namely, their own first cause and creator: that God, whom we believe to exist, and yet cannot comprehend.

These negative words, however, we generally, even when in reality we only use them in a rela-

tive sense, and in order to indicate that certain positive entities are beyond being measured, comprehended, bounded, divided and changed by certain other peculiar limited entities, use in this unconditional and unqualified manner so inconsiderately, as often to risk leading our hearers into a wrong understanding of our meaning.

The word eternal seems only in its origin to have been employed to express, not the absence or cessation of time, that first and most essential ingredient of all things created, and of all sensations and thoughts by which such things are represented in the sense and mind—which absence cannot be comprehended when applied to any thing we can understand or think of—but only, on the contrary, to express a constant replacement of portions of time already gone by, by new portions of time again succeeding them. In this sense alone we can to the word eternity attach an intelligible meaning, or rather, any meaning at all. By degrees, however, the word eternity has been understood as signifying, instead of the unceasing duration of time, its sudden and total cessation, again following, as its non-commencement first preceded its intervening and thus limited existence and flow; and eternity has thus been rendered a nondescript positive attribute, opposed to that other positive attribute time. We talk of a period when eternity shall begin, because time shall have had an end, instead of saying that eter-

nity shall take place, because time, once having begun to flow, shall never cease to exist. Do as we please however, we cannot conceive such a state of things ever to take place: we cannot connect the idea thereof with that of any modification of matter or of mind of which we can form a conception. Of all those entities and modifications of which we can have any idea at all, we can have an idea only as existing within the precincts both of time and of space, and as themselves throughout partly composed of certain portions of both these essential conditions as well of mind as of matter. To us the cessation of time is the cessation of all else that constitutes matter and mind intrinsically and that constitutes our sensations and thoughts relative to matter and to mind. If we wish for a hereafter in which to feel, to think and to enjoy eternal happiness, we must also wish in that hereafter to be conscious of the continuation of that time, through the medium of which we can alone conceive any felicity to exist, to be felt, and to be enjoyed.

Even when by the word eternal we only wish to express that which is destined to be ever prolonged in time, we become, in using that word in a present sense—in saying that a thing actually is eternal—guilty of a vicious locution. Nothing can be intrinsically actually eternal, since eternity, applied to what alone it can justly be applied to,—to the unceasing duration of

time,—comprehends in addition to that time past which is no longer, that time future which is not yet, which never can actually exist, never can actually be present: and since time itself is only the constantly shifting point of transition from its earlier to its later portions.

We use a locution equally vague, equally vicious with the former, and that, in more senses than one, when, in order to express that the modification which we call matter, however minutely it already is divided and subdivided, still remains liable to further subdivision more minute than the former, we describe that matter as, in the present tense, dividable ad infinitum.

The word matter must either be taken as a word synonymous with the word space, and as expressing that modification which, together with that expressed by the word time, is one of the most essential and primary ingredients of all matter more late, and partial and complex, or it must be taken as only, within more general space, expressing certain lesser portions of that matter, presenting a cohesion, a solidity so much greater than others, as to require a greater effort to produce their separation; and as thus only being a word synonymous with the word substance.

Now it is evident that, if we take the word matter in a sense synonymous with that of space itself, no portion of matter can by any entity

situated in another different portion of matter, be divided at all, since mere space is undividable in parts separate from each other;—since objects changing their place, only glide in the space before unoccupied by them, and leave to other objects their own former portion of space;—since all that which objects more partial can effect in space in general, is to render its different lesser portions to the sense more distinct from each other;—and it is equally evident that, if we take the word matter in a sense synonymous with that of more partial solid substance, floating in more general space, and of which certain portions can be divided and removed from others, and in that general space occupy a distance from each other greater than they occupied before, this can still only be affected by gradual extension and movement,—by the assistance of further time as well as more extended space;—and can consequently leave no matter unconditionally, in its present tense, and without any fresh modification not actually present, thus dividable.

And this leads me to observe, that the word matter is, in general, used in such a way as only to present a meaning very vague and indefinite. In order to bear a signification liable to no mistake, it ought to be considered as comprehending the first and most essential conditions of all that may be entitled to the appellation: those conditions without a certain quantity of which no portions

of matter, whether only merely physical or liable also to experience sensation and thought, known to us, can exist; namely, those of time and space. Most people, however, exclude these former attributes from among the number of those which matter of a mere physical sort always embraces, and again, are greatly tempted to discard them from among those on which all intellectual phenomena necessarily rest. Most people restrict the application of the word matter to such modifications as come within the special cognizance only of one or more of those five senses, to which is intrusted the task of receiving certain sensations in part different from those experienced by the others; or, even to such as only to the sense of touch give sensations of palpability, solidity, and cohesion. Thus they render the word matter, instead of applicable to corporeal attributes already much more early, extensive and elementary than those expressed by the word substance, synonymous only with the word substance itself; leave us in possession of no word singly comprehensive enough to embrace of physical entities all the conditions more early and fundamental, namely, those of mere time, space, force and movement; and encumber us uselessly with two words totally different, for the attributes of a more partial and restricted sort which the word substance alone suffices to express.

This consideration will make me deviate from the usual practice. I shall use the word matter in that more extended and comprehensive sense in which it may, from that entity which we must suppose to exist, namely God, but which we can neither perceive nor conceive, precisely because we must suppose God to be the first creator of all that is perceptible and conceivable, on the one hand already distinguish the very first conditions of that matter, namely those of mere time, space, force, and movement, and on the other still distinguish the last and highest developments of that matter, namely those of the most transcendent intellect; and in which it may moreover again, from the modifications of matter more early, general, intangible, and invisible, not yet called substance, leave us the means of distinguishing those other attributes again more late and partial of cohesion and solidity, peculiarly pertaining to that portion of matter, especially marked by the more restricted appellation of substance. Thus only I can make the two distinct words of matter and of substance designate two modifications themselves already in part different from each other.

A confusion, very similar to that which is often made between the meaning of the word matter in general and that of the word only signifying a smaller and more partial portion of that matter peculiarly denominated substance, is fre-

quently made between the different words mind and soul.

The word mind—and those others, really synonymous with the same, of intellect or understanding—mean the whole collective aggregate of the faculties and phenomena, founded as we shall show on material organs, by which, after an individual entity has received from without actual impressions, the sensations produced by these impressions are capable of being again revived and recombined in the shape of other sensations later and more internal, called thoughts or ideas: and of the modification thus called of mind there may be as many specimens or individuals separate from each other, as there are different and distinct corporeal thinking individualities.

The word soul can either be used as only synonymous with that of mind,—in which sense it is at best only useless and superfluous,—or it can only be made to receive a meaning again somewhat different from, and more general than the former, by the former being restricted to such portions of the faculty of thinking as are actually extant in peculiar individuals distinct and different from other individuals, while the latter is alone extended to the faculty, by the author of all matter, instilled in all its modifications alike, namely that of being destined at certain later periods, in certain of its later and

more partial subdivisions and developments, to receive certain sensations, thoughts, and modes of consciousness of other more distant surrounding entities and modifications; no matter whether this faculty is already fully matured and in actual exertion, or whether it still is unripe and capable only of being by more distant future maturity fitted for actual exertion; whether, as the scholastics would have expressed themselves, it already is "in actual *esse*, or still only is in mere *posse*;" whether it already in its later developments be divided among a number of different individuals distinct from each other, or whether, in an earlier and less developed state of created matter, it still be, in its mere embryo condition, collected in a single undivided mass. In order to avoid ambiguity of expression I think we should make it a rule only to use the word mind in the former sense, and to reserve the word soul for the latter, in which we shall only have occasion to use it more rarely.

To the first incomprehensible author and cause of all that we can in any degree perceive, or think on, or conceive either of mere matter only or also of intellect—itself nowhere bounded by time or space, or any other of the positive attributes of that matter or that intellect, precisely because each of these latter is only a later and more partial emanation of this same first cause itself,—I have not dared, I have not been able

to ascend, or to attribute any condition in common with any positive modifications which we do perceive or know, whether they already be among those simpler ones only of mere time, space, quantity, force and others, already belonging to mere body as well as to mind, or whether they only be among those more partial modifications, such as those pictures of entities and events retrospective or prospective traced by the memory or the foresight, which only arise more gradually within certain more partial subdivisions of the modifications of matter called of mind; because, firstly, all the attributes whatever which we do know—those of intellect as well as those of mere unthinking matter—are alike only among God's later and more partial creations, and thus are not intrinsically parts of that God himself before he created them; and moreover, because, secondly, though we are more accustomed to regard the modifications of intellect in particular as qualities more directly inherent in the very essence and nature of God than those earlier and more external ones of mere unthinking matter, they precisely are those which, as only arising at later periods, in smaller and more internal portions of that matter emanated from the first cause, only more remotely, and through a greater number of intervening media or secondary causes, arise from the first cause itself—only called infinite, precisely be-

cause it is not yet liable to be confined or bounded even by the earliest, and simplest and most external, any more than by any of the later and more internal modifications of time or space themselves, which emanate from its bosom.

When I happen to say that of a certain peculiar entity or event of which in my mind I fancy the internal representation or picture, the external reality cannot take place or be presented to my sense, let me only be understood to add, according to the rules to which omnipotence itself seems to have restricted the course of nature; not to imply that the Almighty could not have laid down other different rules, or could not again change those which it seems to have laid down.

Above all, let not, I pray, from any part of my theory taken separately and out of its connexion with the remainder, be drawn any argument against the duty—nay, what with many might have greater weight,—the policy, the expediency of always doing, of the different things alike in our power, those that are considered best and most righteous. Any argument for not consulting the general good in preference to partial interests, pretended to be drawn from my work, can only be founded on a misunderstanding of certain of its principles, and this fault it is often the easiest thing in the world to fall into, since the very same words will frequently,

by a slight transposition, effect this, and make what signified white, mean black.

Viewed in the real connexion in which I intend to offer the different parts of my system, they will present the wisdom and policy of virtue even with regard to the general concerns of this present world, and still more, with regard to those of that world to come, to which all we see around us makes us expect to be ultimately transferred, in a clearer light, I hope, than any in which it has yet, according to my ideas, been shown.

When the customary forms and dispositions of any peculiar idiom cause of a peculiar sentence certain parts to be placed relative to each other in an order different from that in which the different external attributes represented, or the different ideas we entertain of these, themselves arise, hearers are apt, from the discrepancy between the thing represented and the order of the representation, to derive a sort at least of temporary perplexity and doubt. An inconvenience of this sort is often in the English and in other languages of Teutonic origin produced and prolonged by the illogical custom of making the noun substantive, used for the purpose of marking the peculiar genus to which belongs a peculiar condition expressed by a peculiar adjective, not precede the adjective which again defines the later and more partial attribute by

which the later and more partial subdivision of the genus particularly described is again distinguished from other different subdivisions of the same genus, as is done in other languages allied to the Greek and Latin—like the French, for instance, in which, when it is intended to express that of the human genus an individual is of a colour darker than usual, he is called *un homme basané*, but, on the contrary, of making the noun substantive only follow the adjective, and only after the word dark, which thus far may apply to the situation of a room as well as to the complexion of a man, adding that word man which limits the darkness to the colour of an individual of the human species.

In familiar conversation, and where the subject is obvious, this mode of collocating with regard to each other the nouns substantive and adjective, however illogical, is sufficiently understood: in close philosophical reasoning, and especially where a number of different attributes may have to be connected by a single link, and to be represented as belonging to a single genus, I have often found it—by causing the principal object in discussion, and which ought to have been presented first and foremost to the mind, to be kept in the back ground to the last, and then only to be placed where it most interrupted the connexion between the sentence concluded and a new one commencing—render

most difficult the comprehension of ideas that ought to present themselves with the greatest ease. I have therefore tried to avoid it, wherever I could, consistent with the genius of the language in which I write, by dint of such circumlocutions as were calculated to make the substantive, representing the genus, stand first, and the adjective, which only restricted the discourse to a certain lesser subdivision of that genus, follow later. Instead of saying, as is usually done, "a young, and healthy, and handsome, and active, and intelligent"—"what," it may be asked—"man," I have rather said, "a man young, and healthy, and handsome, and active, and intelligent:" and this I have often, on trial, found to be of more consequence to the general clearness of my reasoning than at first sight would appear.

Many things, however, I am conscious of having expressed in a manner much less clear, less terse than, merely by considering more sedulously the natural order of the different subjects to be described, I might have done; but to do this I must have employed more time, and this additional time I was not sure of being allowed.

Having said thus much in explanation of my views, and in extenuation of my defects: having stated—what, indeed, the sequel of my work will confirm—that the object of my labours has

only been to diffuse more generally the cardinal virtues of faith, hope and charity, as rationally understood,—as distinct from credulity, from presumption, and from weakness,—I now take leave of the long egotism in which I thus far have dealt, some may say indulged. I shall first proceed to settle the signification which I wish to be attached to a few more doubtful words, on the right understanding of which depends much of that of my reasoning; and then, without further delay, plunge in *medias res*.

CHAPTER II.

Legitimate sense of the words liberty, power, subjection, faculty, fact, immutability, contiguity, connexion, good, evil, happiness, unhappiness, beauty, ugliness, wisdom, folly, utility, noxiousness, sameness, similarity, and some others.

A TIME may come when, in another world, more perfect than this, of each separate individual the mind shall lay so open to—the inmost thoughts and wishes shall remain so little concealed from—the outer eye of every other individual, that words will no longer be wanted to express those thoughts and wishes, and to communicate them from one person to another; that each individual separately shall, by mere intuition, know what thoughts, what wishes arise in the breast of every other individual, near or distant.

In this present imperfect world, where every wish and propensity of every person individually would not yet always be sure to find a welcome in the breast of every other different person, this notoriety of every mental movement does not, fortunately for man's comfort, yet take place.

To express his thoughts, and to communicate his wishes, man here below still wants the use of words,—but, like every thing else produced on this globe, these words still only answer their purpose imperfectly. They often only express thoughts, in themselves already obscure and limited, in a way still more obscure and doubtful. We are often puzzled to understand what our neighbour means in addressing us.

I shall, therefore, in addition to the definition of the few terms of dubious import already mentioned, of a few more such endeavour to mark the origin and to point out the just application; as being highly important to the right understanding of this work.

To those modifications and entities created, —from the first materials still merely radiant of later solid globes to the latest bodies arising on this peculiar globe, which, even while living and growing still are called inanimate, and, only in their growth and movements blindly following an impulse first given them from without, still are not yet possessed of any internal sensation or will of their own,—no one yet thinks of attributing any degree of liberty whatsoever.

Even of those entities more late and complex in which, at a certain period of their progress, the impressions of certain external surrounding objects are made to produce certain sensations, thoughts, desires, wills and actions of a volun-

tary sort,—and which thus already are distinguished by the name of animals,—that inferior subdivision which still remains unendowed with the peculiar powers of intellect called powers of abstraction or reason, is not yet supposed to possess any freedom either of will or action.

The reason thereof seems to be this, that whatever sensations or later thoughts, always first aroused from without, and producing a will, which again from within tends to produce an inclination to such actions outward as are called voluntary, in the mind or brain of brutes does not yet find, before they actually produce outward any corresponding voluntary action, room sufficient for letting other later sensations and thoughts from without produce other different wills, in their tendency again different from and often incompatible with that of the peculiar wills by the former sensations and thoughts from without produced, and which again balance and check the impulse outward of these former wills, suspend their impulse, prevent their immediate action, and thus, before that action can have its ultimate result, leave leisure for a choice and option between resolves different from each other, and often make an inclination or will, later than another, gain over that other so great a preponderance, as to pass it by, and to produce a preference for some positive action, wholly different from that which the former will sug-

gested,—circumstances which all, after a time, take place in the roomier mind of man, and, in this latter, at last produce that faculty of option denied to brutes.

But as little as, where an entity, from sensations and thoughts first only produced prior to and without the concurrence of any will whatever of his own, subsequently only derives a single will, only impelling him to a single mode of acting, that entity can be said to acquire freedom of will and action, so little can an entity, in which after a certain period a certain number of sensations and thoughts different from former ones and tending to produce wills and inclinations to actions outward at variance with each other, are left to struggle and to fight it out, before any of them by a preponderating impetus finally overpowers the others and leads to the accomplishment of the action to which it tends, be said from these circumstances—from that struggle between different impulses—that ultimate yielding of the weaker to the stronger—to derive that freedom of action which the former entities, to whom the power of option is denied, are said to want.

The movements and wills that, after having been first by involuntary sensations and thoughts from without produced, are left unimpeded to pursue their course till they are vented outwards in corresponding actions, and those that,

after having from prior involuntary sensations and thoughts first arisen, in their progress,—before they have had time to advance outward, till they vent themselves in corresponding actions,—are again by others from within more powerful and producing a rush more potent overtaken and made to give way to their superior impetus, as well as those which in their way outward, by some impulse from without opposing their further progress and exit are again met and stemmed in their course, and prevented from finding their ultimate vent in corresponding actions, all alike derive their origin and impulse from some prior more external cause, arising and acting before these impressions, movements, thoughts and wills themselves are born.

And if we so seldom complain of having been obliged to perform those actions which arise directly out of and coincide with our own previous will,—however noxious their later results may prove to us,—and on the contrary, so often complain of certain others, prompted by our own will itself, being by some external cause prevented from being executed, or others again being in defiance of our own inclination by some external impulse forced upon us; this is only because, in the former case, the fluids left to convey the impulse of the will from the brain outwards to the organs of action, when there

vented, there immediately produce a sensation of pleasure, which, even where again the consequences of the action at a later period produced pain, only caused that sensation of pain to be too far removed from the first cause of the will itself to have its idea connected with that of the said prior will; whereas in the latter case, the fluids carrying the impulse of the will from within outward, in the very act of flowing out, and before they are vented, and have had time to give that prior pleasure, by some external impediment arrested, repelled and forced back into the body, produce a sensation of pain more immediately following the impulse outward.

All will, all thought, all sensation which precedes and causes these thoughts and volitions, thus being, even in man himself, in their origin alike involuntary, must, by the links of a chain of prior causes that ascend in unbroken connexion till they originate in the first Ruler and Creator of things created and cognizable, give to that Ruler, that Creator—to God alone—ruled by nothing prior, nothing more external which we know of, on every side that real unbounded liberty of which nothing created can boast but by self-deception.

The noun substantive power derives from the Latin verb potere—to can: the noun substantive faculty derives from the Latin verb

facere—to do. Both imply alike the possession of all the means, physical only or also intellectual, necessary to bring a thing about; since we cannot fancy any thing being actually effected, without also fancying the possession of all the means necessary to effect it. In common parlance, however, the word power is often applied more generally and indefinitely to entities and modifications which possess these means unconsciously as well as to those which possess them consciously; while the word faculty is applied more definitely and pointedly to entities which only possess those means consciously.

Power unbounded, faculty unlimited, ability at the same time, from the same place, to act backward and forward; to impel all round, without being previously from any side and in any direction by any prior or different power impelled,—power, faculty, thus liable to no prior subjection, and by no power more early and external acted upon and produced,—cannot be conceived to exist in any entity, created by a prior being different from itself. The simple fact of an entity having been created by another entity different from itself, implies its having received its powers and faculties from that other different being, to which it consequently remains subject. We can only suppose a power derived from no prior subjection, impulse, force—if by the name

of power it can be called—to exist in the first cause, itself uncreated, unproduced, of all later and more partial entities perceivable and conceivable, that have been created by it.

In things created, from the very first, most simple and most general,—such as time, space and quantity,—we cannot conceive the existence of any power, any faculty, any force, any action manifested in any particular direction, which proceeds not from a particular subjection and passiveness, by a peculiar prior power, force, impulse first from without in that direction produced. All things created, more partial than mere time and space, seem only to be in time and space by some other force earlier and more external than time and space themselves driven on in the peculiar direction in which they move and advance. It is only in the bosom of Omnipotence alone, which has been able to bring forth all things created and subject to prior power, that this power to create and rule all things perceptible seems first to originate. That Omnipotence alone, which has had the power first to bring them forth, has that later power of moving, of modifying, of modelling and of ruling them all alike. Only in virtue and through dint of their entire subjection to God can any of his productions, his creatures, acquire and exert, immediately or mediately, over other entities created

by him any later secondary more partial and delegated power, itself only arising out of their prior subjection to his fiat. Nay, every entity and modification, later and more partial than mere time and space, and withinside these two most early and general modifications of matter, by God created, unto those that by degrees acquire, with regard to certain other entities and modifications created, the secondary delegated powers and faculties most complex and varied, remain to the last not only subject to and ruled more primarily by God himself, but by God's earlier intervening creations,—from those of time and space themselves,—through the medium of which they were at second hand previously more proximately produced.

In common parlance we generally distinguish from the mere power or faculty of doing a thing the actual present deed: we often maintain the former to exist long before the latter arises out of it, or even where it never produces the latter. We say that certain modifications have the power of killing, where there is no one yet on whom death can be inflicted; that certain entities have the faculty to make us laugh, while we still are more inclined to cry, and the like. All this only proceeds from a certain laxity in our ideas, which causes them not to comprehend all the different external conditions, of which the actual concurrence and meeting is necessary to produce the

entire fulness and presence of the power of performing the thing in question; which, provided of the conditions all alike indispensable to the performance of that thing a certain number only of the more obvious are present, omits the consideration of the others less tangible, such as those of time, place and circumstances and deems the faculty, while it still only is probable and proximate, already to be present, and entire, and certain.

But in order for a faculty to be actually complete, and certain, and present, it is necessary that all the conditions of time, space, quantity, proportion, force, impulse, movement, substance and others, whether only physical or also intellectual, necessary to produce and to complete it, should not only all be in existence, but actually all, without any exception, be present, and joined, and concurring; and the proof that this condition is necessary for the completion of the faculty lies in this, that, however proximate they all be, as long as of them a single one, however trifling, yet remains in time, space, or quantity at a distance from any of the others—as long as any of them co-operates not yet on the spot with all the rest in the actual production of the event expected,—the faculty of producing that event may again, before it take place, be further removed in time and space, or be entirely annihilated and destroyed in its very roots.

Take a man of whom we say, that he has the power—the faculty—to buy bread, only because he has the money necessary to buy that bread, and because he is in communication with a person who has that bread to sell. While he does not actually buy that bread, how many things may still happen to prevent his ever attaining the complete faculty of doing so? He may be struck dead; the person who had the bread to sell may fall in a fit; the very bread be destroyed, and the faculty of purchasing it never come to maturity.

Indeed there are certain things of which the conditions, depending on further increase of time and on further extension of space, can never be said actually at any single moment to exist and be present. Such is what we call the divisibility of space ad infinitum. However much any particles of matter, already divided, may again be subdivided, it is plain that every further subdivision, depending on further time and further space, still can never be called present, and that whenever this subdivision happens it moreover still must, as before, leave the particles of matter bounded in time and space.

Nor are these to be deemed mere verbal objections and sophisms, as at first sight they might appear. They arise from the very simplest and most fundamental attributes of the very earliest

and most elementary materials of all other modifications physical and intellectual—from the very intrinsic nature of time and of space.

As evident as it is on the one hand that, while of the conditions necessary for a faculty to be complete and to ripen into a positive and present fact any one, however trifling it may appear, is not yet present, not yet concurring with the rest, there can as yet only be a probability of—an approximation to that faculty; there cannot yet be the certainty, the fulness, the presence of it, as evident it is on the other hand that, when of the conditions necessary to that faculty the whole is complete,—when none any longer lag behind, or remain separated from the rest,—when all concur—the faculty can no longer remain only probable, or distant, or dormant, but must immediately at the very instant, and on the very spot, produce the action; so that in their fullest extent the faculty of doing a thing, and the deed, must be synonymous.

The only entity which we can suppose to remain the same during different successive portions of time, and in different simultaneous portions of space, is that imperceptible, inconceivable first cause of time and space themselves—that God, who must be wholly different from, and beyond, and unlimited by the partial limits of each different portion of time and space,

because he himself caused every portion of time and space, from the earliest and outermost, first to be, and next to be connected with all the remaining ones.

Nothing which by man can be perceived or conceived can be so as remaining intrinsically, during the smallest perceptible portion of time, or in the smallest perceptible portion of space, the same that was before; since of time and of space themselves every portion, however minute, however contiguous to another portion different from itself, can only be perceived as no longer the same with—as different from that other; and since all else of body or mind that can be perceived or conceived, can only be so in certain portions of time and space.

Every one allows at first sight that of time every new instant or portion, added to a former portion, is already only perceived as a change from that former portion from which it is already again allowed to differ; and every one must, on the least reflection, equally admit that of space —though on the first view it appears the most unchangeable of attributes—the smallest particle that already can be discerned as different from another—as being at all,—can only, like every measurable portion of time, be perceived or conceived as being a mere aggregate of differences.

Now, all else physical or intellectual which

can be perceived, only perceptible as in part and fundamentally formed of portions of time and space must necessarily partake of the most essential requisites of time and place themselves; and must, in all its lesser component parts successive and simultaneous, alike constantly offer change and difference.

The most permanent rock can already only be considered as throughout a mere aggregate of constant change and difference; and man himself, the most mutable of beings, can only be regarded as an aggregate of changes and differences more rapid, more numerous and more varied. Already while we behold the rock, it no longer is the same in time on which we first cast our eyes; and if we contemplate its different parts, there is not one, however small and contiguous it be to another, which does not in space as in time differ from that other.

We can thus only call certain modifications, situated in certain portions of time and of space different from others, however minute and contiguous to the first those others be, the same with those others—we can only call an entity which was yesterday the same that is to-day—we can only call a man who was at Paris last week the same man that is at present in London—by abstracting from the idea of that man the image of the changes it must have undergone in

time, and of the differences it must present in space since his trip to Paris; and by thus only taking the word sameness as synonymous with that of similarity. We must not heed the real changes of time, and the real differences of space which, though every where constantly taking place in the different parts of all entities physical and intellectual perceptible to us, still in reality only leave them similar to what they were, in order to assume the privilege of calling even those parts of them different from each other which in time or space still are contiguous, and together only form a single individual, during the smallest portion of successive time or of collective space, positively the same.—To call the full grown tree the same even with the earlier plant; the full formed man the same even with the earlier infant, out of which the latter continuously arose. In other words, we must in our mind from the idea of two objects different from each other,—from the external reality of which can never, as far as we know, be detached the attributes of change in time and difference in place,—abstract the idea of that difference, that change, ere we can call these entities, in reality different from each other, the same.

But while nothing that in time or space is different from another thing can be called wholly the same with that other, nothing that in time and space still is the very same can yet be called

similar only. A thing must already in time and space offer certain differences from another thing, or from its former self;—of what is collectively still called the same genus, must already be discerned individuals or parts in time or at least in space different from each other,—before they can become liable to a comparison with, and be found not only different from, but even again similar to other individuals or parts of the same genus different from or earlier than themselves. A man at a certain age can only appear either already different from, or still like a man of an earlier age, with which we still call him identically the same, because he only proceeds from and is only a continuation of that former man, and thus already in so far is in reality different from that former man.

While the imperceptible first cause, God, alone, as not being liable to any of the conditions of time and space which he himself first created and contains, still ever continues the same, all things created by him perceptible to us, whether merely physical or also intellectual, however different they be from each other in the portions of time and space they each occupy, still each, in necessarily occupying certain portions of time and space, already resemble each other; and as by later developments they acquire further differences from each other, with these further differences from, also again acquire new similarities with each other.

We only call certain portions of time, of place, and of other attributes corporeal only or also intellectual of the same or of different sorts, contained in portions of time and place, whether they be small or large, few or many, while they are unto the last in time and space contiguous to each other, collectively, single individuals. When they no longer are thus in time and space contiguous to each other, we no longer call them single individuals, though we still may call them parts of the same genus.

Of time, of space or of other attributes corporeal or intellectual, contained in time or space, we call the parts, which, whether continuous or distinct, resemble each other, in as far as they resemble each other, parts of the same single genus.

Parts may be of the same genus and belong to different individuals: parts may belong to the same individual and to different genera.

Contiguity begins before connexion. Of time and of space alone lesser component parts may already be contiguous, but seem yet incapable of being connected with each other, unless they be, by the assistance of some other attribute, different from themselves, thus connected. Continuity is positive, and has no degrees. Connexion begins in smaller degrees, and thence extends to others more extensive and more forcible.

The very same external objects which, com-

pared with certain others, offer attributes and make impressions of a peculiar sort, when compared with other things again different from the former, again offer attributes and make impressions wholly different from, and often contrary to, these former ones.

The very same mouse which, compared with a flea, shall appear of colossal dimensions, compared with an elephant will appear most diminutive. The same event which with regard to the first creation of the globe will appear late, with respect to the occurrences of the present day will bear an early date. The food which to a man in health is wholesome, useful, pleasant, to an invalid is injurious and disagreeable. Those features which in a monkey are handsome, in a human being are hideous. Those measures which in a man possessed of money may be wise, good, capable of producing pleasure, profit and happiness, in a poor man will only be foolish, injurious, and capable of causing loss, pain, and misery. What to a sensualist gives delight, to a man whose mind alone is expanded may occasion mere ennui.

The honied poison may begin by affording pleasure to the same person on whom it ends by inflicting torture. The toothdrawer often gives present torture with the view of producing future solace. That which in a man young, healthy and likely to enjoy a long life is wise,

prudent and useful, in a man old, infirm and on the verge of the grave, may be the height of imprudence or folly. That which in the mind of one who entertains no hope of a future existence may be a sound calculation, in the idea of one convinced of the immortality of the soul may be a silly conduct. What in one respect is good, pleasant, beautiful, in another may be bad, irksome, ugly.

External objects are, with reference to their capacity of immediately affecting the sense or mind agreeably or disagreeably, called pleasant or unpleasant, handsome or ugly. With regard to their capacity of affecting the sense or mind more remotely, and at a more distant future period only, with such feelings of pleasure or of pain, they are called good, useful, wise, virtuous, or bad, injurious, foolish, vicious.

But things may often only, through the means of prior intervening effects called irksome, like those of labour or of medicine, produce more distant pleasures, like those derivable from health or plenty; or they may, through the means of prior intervening effects called pleasant, such as those attending on excessive indulgence, produce future pains, like those of illness or privation. And thus the same things which, with reference to their immediate results are called good, palatable, pleasant, beautiful, with regard to their more distant consequences often deserve the

name of bad, disagreeable, detrimental, ugly; and the same things which, with regard to their immediate effects are called bad, nauseous, disagreeable, irksome, ugly, with regard to their more distant consequences often deserve the name of good, useful, and praiseworthy.

CHAPTER III.

Causation, or relationship of cause and effect. Primary cause, itself imperceptible, inconceivable, of all other causes and effects later and more perceptible of a secondary sort emanating from it, called Jehovah, God. Immediate effects of that first cause, in their turn called the secondary causes and media of other causes and effects again later than themselves.

When the sensation of an entity or event of a peculiar sort is frequently in time and space immediately followed by the sensation of another entity or event of a peculiar sort still in part similar to, though in part again different from the former, we gradually begin to believe that the external modifications which produce the former species of sensation, are in part the cause of the external modifications which produce the latter species of sensation—or, in other words—that the external modifications that produce the latter species of sensation, are in part the effect of the external modifications which produce the former species of sensation: and this peculiar relationship of cause and effect which we sup-

pose to exist between the causes of certain sensations and of certain others, has of late years received the peculiar name of causation.

There are people who have denied that in things perceptible there is any real relationship of cause and effect; who have said, and justly: "while we see not yet in time and space two entities or events, in their intrinsic modifications at all different from each other, we cannot behold one as the cause of the other, and another as the effect of the former; and as soon as we see two entities or events at all in time and space different from each other—a thing which can only take place by the one occupying a portion of time or of space, which though still contiguous to, is already different from that occupied by the other—there no longer is any proof positive that the one ever in part contained the other—that the other ever in part arose out of the former. Their contiguity may only arise from later coincidence or juxta-position.

If on a tree, on which we first only beheld a white blossom, we afterwards see on this white blossom superstructed a hard green fruit; and afterwards again see this hard green fruit gradually replaced by a juicy red pulp, how are we to obtain a proof positive, that the former appearances are themselves in part the cause—the foundation of the latter phenomena; that the latter in part arise out of the former; that what in the latter

is different from the former, is, and can be superstructed only on what in this latter still is similar to the former. Why may not, in some mode concealed from our observation, the former substances and shapes and colours have been replaced by the later ones, without these later ones having with the prior ones any direct or necessary connexion; without their being partly produced by and arising out of these former ones themselves?

And the people that thus denied all connexion of cause and effect even more late and partial between things perceptible, have of course also denied all connexion between later and more partial modifications perceptible to our sense, and an earlier cause of these modifications itself still imperceptible and inconceivable.

Strictly speaking, we cannot controvert their assertions by proving positively that there is a prior cause still imperceptible of all effects perceived.

But the want of mathematical proof that a peculiar thing is, can never alone, and independent of the proof positive—the evidence—of the existence of another and a different thing with which that of the former is incompatible,—which leaves no room in time or place for that of the former,—be construed into a proof positive that the former does not exist. I may still, even without such proof positive of the existence

of that former thing on just grounds believe it to exist. And the more I feel, and experience, and observe, and think, the more I infer and believe that causation exists: that certain things only can contribute to the production of certain other things, in part still like them, though in part again different from them: that certain things can only, more proximately or remotely, in part arise out of certain other prior things which they in part still resemble, though they in part again differ from them.

Nay, by degrees I have been, like many others before me, led by my sensations, my experience, my thoughts, most firmly to believe that all modifications of an intellectual nature which we behold, arise partly out of prior modifications still merely physical; and all modifications merely physical later and less comprehensive than and included in those of space and time, in part out of those of space and time themselves, which, though the earliest and the most comprehensive that we can behold or conceive, must, by further analogy, in their turn, together with all the other modifications later, and less, and more partial physical and intellectual yet perceptible, comprehended in time and space, again arise out of other modifications, again in part different from each of these perceptible modifications singly, which though themselves still imperceptible, nevertheless already are; and of

which I call the first cause and author Jehovah, God, the Deity.

All that we can feel, or think, or know, no longer being this first cause, this Deity in its undivided whole—only being of this first cause —this God—some of the later and more partial emanations; only being certain of the media more proximate or more remote, already different from the Deity itself taken in its whole, through which that Deity again produces other entities and media still later, more partial, more different from that whole than themselves, we can of this whole—of this first cause—of this Deity, as such, not know the intrinsic attributes; or through any of the conditions either merely physical or intellectual which we do know, describe these attributes.

Perhaps, however, it may not be improper or wholly inapposite to say that all the media which the Deity first brings forth, and through which it creates other things perceptible; and all the impressions it gives these things, and all the consciousness certain of these things or entities receive of these impressions of prior things must, in their capacity as emanations from the Deity, alike be integrant parts of that Deity itself, which thus chooses, under the different peculiar forms it successively assumes, not only to make, but, in our name and under our appearance to receive, the peculiar sensations, and even for a time to

experience the peculiar ignorance or lack of sensation to which we creatures are liable. Perhaps when we feel or recollect any peculiar modification, from the simplest of matter to the highest of mind, it is the Deity itself which we feel in that shape,—as Mallebranche has already vaguely thought and said; and if so, we should ourselves unconsciously still all be parts of the Deity; which in fact as emanations, as creatures, as children of that Deity—for such we are even in Scripture called—and as thus still partaking of the nature of our common father, we are justified in thinking ourselves.

Ignorant as we are of the intrinsic nature of the first cause of our being, of our sensations and of our thoughts; ignorant as we are of our own intrinsic nature; ignorant as we are of the intrinsic nature of the very media emanated from the first cause, through which it has lighted up in us consciousness, sensations, and thoughts; able only to say that a first cause must exist, and that secondary causes must flow from it—since I have sensations of such, all I can do is to give of these secondary causes or media, and of the order in time and space in which they arise relative to each other, the most faithful account which the sensations received of them suggest.

But before I begin to do so, I shall first observe that we must have the sensation or idea of two events or entities each different from the

other, before we can conceive the idea, or draw the inference, or entertain the belief that the one is in part the cause, the author, the parent of the other—that the other is in part the effect, the production, the offspring of the former; nay, that we must believe a thing, in part the effect of another different thing from which it in part again differs, to be in that other part in which it again differs from that prior thing, the effect of another prior thing, again different not only from the later collective effect itself, but from the prior cause of the other part of that collective effect, and which that other part again in its turn resembles,—since it is only from the resemblance of certain things to other prior things that we infer their being the effects, the offspring of these former things; that consequently each later effect must singly present itself as derived from the union of more than one prior cause, each already intrinsically different not only from the collective result of that union, but from each of the other different prior causes of that union, taken separately.

CHAPTER IV.

All descriptions, from the very nature of their materials, offer certain difficulties and defects: description of time.

I HAVE already hinted, that if of a mere history or series of successive events, presenting few parts simultaneous in proportion to those that are only successive, and resembling a stream of great length, but throughout of narrow and equal width, the narration can, in the order of its different successive parts, to the real order of the original represented, retain a similitude sufficiently close to allow the easy representation of those events to the imagination of the reader, of the general developements of nature, like the stem of a tree at first very close and compact, but rapidly on all sides shooting forth into ramifications different from each other, all spreading simultaneously, the description in words, which can only represent what itself takes place simultaneously, in slow succession, presents difficulties very great; and the greater, as of each simultaneous developement different from others the partial description, more explicit and detailed, makes that of the whole advance more slowly. These dif-

ficulties are still increased by that of the things in reality most closely connected still having their descriptions necessarily divided by the words in which these are conveyed.

Often this defect has been in part obviated by descriptive tables, in which of different objects the simultaneous ramifications are first represented more rapidly to the eye, before they are afterwards more in detail repeated through the channel of the ear. But this very repetition of the more essential parts of a subject becomes tiresome to the reader, and causes either the tables or the explanation to be soon neglected. I shall therefore trust to the more mobile mind of that reader himself for forming, of the developements which I can only describe in slower succession, a picture more rapid and more simultaneous.

It would perhaps be going too far to say with Berkeley, that between God, the first cause of our sensations, and between those sensations themselves, there exists no intervening medium—no intermediate external world; that those sensations are all that exist outside God; and that only, because we know nothing of such a world, save what those sensations give us room to conjecture respecting the same; though it may not be too much to say that we do not see any indispensable necessity for such an external world, merely to secure our happiness, or to afford a clue by which

our will may be led in the path of that happiness, and deterred from the road to suffering; as long as the sensations we receive themselves follow a certain regular order simultaneous and successive relative to each other, through the knowledge of which that will of ours may be more immediately or mediately made to attain such of these sensations as tend to enjoyment, and to avoid others of them that lead to pain.

And this order simultaneous and successive these sensations do follow; and as they are the only things of whose intrinsic nature and whose order relative to each other we can have any knowledge, and through which we can attain any idea of the existence or nature of the more external objects which they are supposed to represent and to arise from, we shall make the account of them stand for that of the external objects themselves; begin with that of the most early, most comprehensive and most elementary of them, and from these gradually, as they produce others more late and partial more proximately or more distantly, pass over to the description of those others more late and partial, which through their medium God is pleased to bring forth.

Of the first great cause itself still imperceptible,—itself still liable to no definite quantity, limits, division—of all the possessing quantity, and liable to limits and division, the partial effect, medium and modification already in some

degree perceptible to us, liable to limits and to division, and, through itself transmitting these attributes to whatever else it contributes to compose, which seems the first to arise, and the first also in sentient entities to arouse a consciousness of its existence, is that which causes the sensation of time.

Sensations of time can be experienced without those of any other modifications either of mere matter or of mind; but no other modifications whatever can be known except as included in certain portions of those of time. It already takes some successive portions of what is called time or duration even to perceive what are called different simultaneous portions of space, and as of any objects merely corporeal more partial than modifications of mere space the sensations still occupy certain portions more partial of the sensations of time, so of these later sensations of time itself the still later mental thoughts again occupy other still later portions of the same sensations of time.

Omnipotence seems, of the time poured out of its bosom, to cause the portions already perceptible to be constantly followed by fresh portions flowing out after and driving on before them the former ones, till they again vanish from the sight. Of time, always continuing to roll on in one single straightforward direction, each individual portion seems already gone by or not

yet arrived. Still, as new time starts up on one side, former time seems to steal away on the other. No portion of time appears ever stationary, present, able to be grasped, retained, dwelt upon, or, after it has once gone by, again able to be recallable, so as to be re-experienced, re-tasted. Even former time, already felt by the sense, can only by actual fresh later time be represented in the mind; and if we call any sensible length of time, collectively taken, in its whole or in any of its lesser perceptible parts actually present, it is only because we take not the trouble of distinguishing any of its lesser component portions, partly already gone by, and partly yet unexperienced, from each other.

As time only advances in one direction, it can only be said to have perceptible length, not width; to be composed of parts distinguishable from each other such as are successive and coming before or after certain others, not such as are simultaneous and at the same instant appear to the right or left of others different from them. As time is always passing by, and leaves of its former existence no relics, and as new time has no permanence, old time is only a figure of speech. Time, not able intrinsically to last, is not able to grow old. Time existing is ever new, young, and fresh. The very hour of its birth is that of its demise. Time is only said to grow, or even to continue, while it drops away at one end and

makes room for new time to replace it from the other; whereas space, as we shall see, may be made to grow equally by new parts added on externally to former parts still subsisting, and by the former parts themselves being again internally divided into lesser new parts.

As time is ever fleeting, it ever eludes actual measurement. Of that which is gone by we cannot know the intrinsic length. We only infer its duration from the extent of the space over which it has run; from the number of changes it has successively brought forth. Only through the division of and comparison between portions of space different from each other, over which different objects are made to run simultaneously, have we of the comparative duration of their movement the means of forming an estimate. Where successive rounds and repetitions of what we regard as similar movements take place one after another in the same space, we have no means of directly ascertaining the different duration they successively present, or whether they do employ a duration at all different.

We have no means of ascertaining whether of time the successive portions which we experience succeed each other with equal or with different speed; whether by degrees the succession becomes accelerated or slackened, expanded or condensed; whether year after year the planets continue to revolve round the sun

in lesser or in greater portions of duration than they did before, or thus of calculating through the peculiar rapidity with which flowed prior time, that which is presented by the flow of time more recent.

As the Omnipotent seems constantly to be pouring forth fresh time, and as fresh time is required for every other different new developement of matter, God can only be said to have rested from the labours of the creation—if labours they can be called—figuratively, not really. New creations of time must ever be going on, because new appearances of other modifications which only through dint of time are brought about and matured, are ever continuing. Indeed, as time is in part the foundation of all else of matter and of mind perceptible to us, any stoppage of time must imply a stoppage, a stagnation, a ceasing of all else that is perceptible. If such an entire stoppage could ever take place, it could not be perceived. We could not any longer by the partial advancement of some things, estimate the lagging behind of others. At the conclusion of this general stoppage things perceptible could only again, from where it first began, go on in what must seem uninterrupted continuation.

Of an aggregate of time the successive portions are not perceived, or only perceived faintly, as long as in it arise not, or are not presented to the sense other changes more partial but more

palpable, through the medium of which we are made more distinctly to mark and distinguish the different successive periods of time itself in which they take place.

Of time the longest aggregate, undivided, unmarked by partial changes, would only seem an instant; and only as changes more rapid take place in time does that time itself, the recipient of these changes more numerous, appear longer.

A portion of time is necessary to the production, the existence, the perception of all else we know. Without a portion of time on which to rest, nothing else perceptible can be conceived to exist or to be perceived. Even space, in order to be perceived, requires a portion of time; and as time itself ever changes, ever loses its identity, ever makes way for new time, every thing else perceptible, founded on and included in time, must ever fare the same; must ever change—ever be different from what it was before.

There is thus more truth, less sophistry than we think, in the saying of Protagoras of Abdera, when he maintained that since every thing must, in its most fundamental conditions of mere time and space, ever change, nothing which we perceive has any intrinsic permanent existence;—in maintaining that nothing which we perceive, strictly speaking, is.

CHAPTER V.

Space, extension.

It is not a little singular that while time—duration—of which no portion is perceived to be permanent, or to last even a single instant; of which every part is ever new and different from every prior portion, has nevertheless been pronounced—and justly—as being in itself a positive attribute, space, extension, on the contrary, of which each part once produced seems to remain unceasingly; of which no part that has once appeared seems ever again to disappear; of which, as well as of time, certain portions are found necessary to the existence of all other different attributes of matter and of mind more partial than itself perceptible to us; which, like time, is in part the indispensable material of all these attributes; without certain portions of which, added to certain portions of that of time as their foundation and their materials, no other attributes can find room to exist or to be perceived, has nevertheless been pronounced intrinsically a mere nonentity, and has only been called the room in which other attributes more positive might be produced and placed;—as if that room, which itself is in-

dispensable to the appearance of these other attributes; which may exist or not exist, and which may in some places be more capacious than in others, were in itself nothing: as if the very difference between where such room does not exist and where it does, and between certain portions of it and certain others, did not already prove it to be in itself a something positive.

Far from adopting this idea, space, like time, to me appears actually to be in itself a something positive, a something created, a something of which the being or the not being makes a prodigious difference, independent of that of the attributes more late and partial again made to appear within it: a something of which, as of time, in a dreamless sleep, we may have no perception, while when awake and receiving sensations, we may of it have a positive consciousness, even though we actually have not yet a consciousness of any thing else more definite and distinct contained in it; since of space as of time we may perceive portions different from and larger or smaller than others, and since whatever may be compared with something else, and have of a peculiar condition a greater or a less quantity, must in so far needs exist and be perceptible.

The first cause, itself imperceptible, of all effects perceptible, seems to have endowed every individual portion of space, as well as of time, which we can fix and distinguish from others, with its

distinct and definite limits; and however contiguous a peculiar portion of space still be to another different portion of space from which we can already distinguish it, to have rendered it incapable of presenting with that other portion any identity in place—to have already situated it to the right or the left of, over or under, above or below, that other different portion of the same attribute.

It seems doubtful to me whether the conditions of space proceed directly and without intervening medium from the first cause, and only are in part again subsequently joined to those of time, or whether only through the prior medium of certain portions of time themselves have been formed those of space. This alone seems certain, that only through the intervention and medium of successive portions of time we can recognise, survey, and be sensible of what we call even simultaneous portions of space different from each other. Viewed through the medium of time, as all space must be by us, it however presents conditions very different from those which time itself, void of accompanying space, presents.

While of fleeting time, taken singly, the different portions seem only each to appear in succession and in a single forward direction, of stationary space the different portions seem in great measure from first to last to remain simultaneous, and to stand by the side of each other, so as to

stretch out in every direction, right, left, upwards, downwards, forward, and backward.

While of time, of which every individual portion vanishes as soon as it appears, the general mass alone seems to increase or rather to continue existing—and that only through dint of constant new portions replacing the former ones gone by—of space, ever remaining, the aggregate seems to increase in reality, partly by its former external boundaries having new and more external boundaries ever added to them, and partly also, at least in appearance, by having its internal divisions and recesses ever further subdivided and multiplied.

While of time there only seem to be portions which differ from others in being prior or subsequent to those others, of space there exist portions, simultaneous with others and yet different from them, in being either withinside or without-side those others.

While of time the portions seem each constantly themselves to change, to become new and different from prior ones, of space the portions seem each intrinsically constantly to remain unchanged,—the same that in time from their beginning were, and to their end shall be; and each, wherever they can be individually fixed as distinct from others simultaneous with them, seem only to differ from these others in the place which, relative to these others, they permanently occupy.

While evanescing time only collectively continues to flow on by ever presenting new portions replacing the portions preceding them already elapsed, sturdy space, maintaining its ground, only every further instant of duration grows older. If such imperfect similitudes were admissible, I should say that while time resembles the rolling of an immense cylinder, space resembles the form of a stationary globe.

While of time no portion whatever admits of being grasped, laid hold of, retained, and when gone by, again resumed, or by sentient entities themselves again reverted to and retasted;—while of time the portions only resemble the waters of a rapid stream, that soon disappear and plunge into a fathomless ocean, of space every portion, unto the most minute, like the contents of a tranquil lake, seems ever capable of being fixed, dwelt upon, seen through deeper and deeper, and, however often quitted or looked away from, again from the greatest distance able to be returned to and revisited.

While of future time certain subdivisions can only by the subdivisions in space over which an object is to move, by anticipation be made measurable, of space past and still present, certain subdivisions can have their capacity through others, situated within or withoutside them, directly estimated.

Of time the lesser portions present not any

peculiar order, relative to each other, in space, by no parts of which latter condition they can be bounded. Of space the lesser portions present not any peculiar order, relative to each other, in time, by no parts of which earlier attribute they can be limited.

While time, only passive with regard to the first cause alone whence it first emanates, seems to be of that first cause the effect, or secondary cause, most active with regard to all other later effects, space seems to be of that first cause a later effect, only through the medium of time itself at second hand produced, which, by time again impregnated with, and rendered the womb of all other attributes later and more partial than that space itself,—from those of mere force, impulse and movement, to every other of mere unsentient matter or of mind arising in space—is from beginning to end wholly passive.

Time is always moving: space seems wholly immoveable. Space can only by time and by other objects formed in time be invaded, be occupied, be tenanted; not be moved, be displaced, be annihilated. All mere change without motion only requires new time. All motion is through change of time performed in difference of space.

In the same way as we are destitute of means to know whether of time the portions can be intrinsically more condensed, and run more

rapidly at one period than they do at another, we are destitute of means to find out whether of space the portions can intrinsically be more condensed in one place than they are in another. This only we can say with certainty, that as of time so of space the lesser portion only through dint of other attributes more numerous, varied, distinct and partial, perceptible in and occupying lesser portions of them, become ever more marked and more distinct; and that as of time, whatever be its length, the utmost duration would only seem a single instant, so of space, whatever be its surface, the extension would only seem a single point, while no other attributes, distinct and different from each other, rose within its different portions to show their capacity.

As of time and of space the attributes are the simplest and most comprehensive which can be perceived, it follows that when these fail to be felt, nothing else whatever remains perceived; and that, if these should happen not to be continuous, but to have a gap, that gap, filled by nothing else perceivable by us, could not itself be perceived.

Even in sleep, though time runs on, and space continues to surround us, while we receive not in dreams any perceptions of these attributes, we can receive, even in the shape of dreams, the perception of nothing else.

To us the whole extent of successive time

and of simultaneous space which we can perceive and conceive seems continuous—seems only to be one single undivided aggregate. When geometricians think they can separate from each other certain portions of space, before continuous, by intervening lines, they separate not these portions of space in reality from each other. They only cause certain of the portions of space, intervening between other portions of space more distant, to contain attributes of a visible sort more marked and distinct than those others. When such intervening lines are employed for that purpose, their own extent ought always to be kept in mind, and be expressly added to, or positively deducted from, that of the intervening space on both sides of them, in order fairly to estimate the dimensions of this latter.

Of certain portions of space, the general extent and quantity, relative to that of their own lesser component parts, or relative to that of other different portions of space, is called their size. The direction relative to each other, in which these different portions of space are situated, is called their shape. The situation in which they stand relative to other surrounding space, is called their place.

As of the perceptions of time and of space the outskirts are immediately next to the absence of all perception, they are, while yet wholly un-

occupied by the perceptions of any other attributes that serve to distinguish certain of their lesser component parts from others, the least marked and distinct yet of any perceptions whatsoever. Only when other attributes, perceptible to certain senses in particular, such as the senses called of touch, or taste, or smell, or hearing, or sight, again subdivide aggregates of time and space in lesser portions, do in respect to these secondary attributes different from each other these more partial limits of these lesser portions become more distinct, and the capacity of the whole which contains them more evident and striking.

Mathematicians have puzzled their brains to define an unextended or intrinsically immeasurable point of space—and no wonder! We can only define what we can conceive—what we can measure—what positively differs from something else. Time is in all its perceptible portions measurable: so is space; and a point of space that is not intrinsically measurable—that is, properly speaking, immense—is not. Such a point, if it existed, could not, by aggregation with other similar points, be capable of acquiring greater extent than it possessed singly. Of such points no number could collectively present a greater mass than a single one can do. No quantity of such can form a measurable line, or surface, or extension in any sense. All exten-

sion, all surface, all size, only depends upon, only consists of, an aggregate of lesser portions of space, which, though smaller, are themselves already through time dividable in others still less than themselves, and thus are through such still measurable. The difficulty of the definition lies in the thing to be defined not existing—not being possible:—in the terms through which it is expressed intrinsically presenting contradiction.

What is by the courtesy of language called an immeasurable point of extent is not any extent at all, or is only the beginning of an extent actually measurable. It is only the place in surrounding space where two or more portions of positive measurable extension meet and come in immediate contact—where they thus leave no room for other intervening points of space, either immeasurable or measurable. An intrinsically immeasurable point is the limit from whence measurability first on all sides begins, or where it again ends.

There are not, in reality, in space, points destitute of extension, lines destitute of width, and surfaces destitute of depth. We only fancy such to be, by leaving the representation of the latter attributes of the modifications possessing them indefinite in our mind,—by confounding the mere sensation of a surface only, which of an aggregate of extension or space is all that we

can perceive of it, with the reality of that aggregate, such as alone, outside our sensation of it, we can conceive to exist. Space, in reality, where it exists at all, ever extends, as we can conceive it, to a certain degree alike in every direction.

Each later attribute than those of mere time and mere space, which becomes perceptible to us, can only arise, or at least, can only become perceptible to us, in certain portions of the perception of time and of the perception of space. Of the rudest modifications of external matter, every portion perceived by us occupies, together with some positive portion of mere time some positive portion of space; and of the finest and most volatile phenomena of mind, by which that external modification of matter is represented, each portion still, in the brain of man, occupies a certain portion of time and a certain portion of space dividable into lesser portions, in which the modifications of that external matter are depicted.

CHAPTER VI.

Quantity, number, proportion, and their effects.

Of different attributes or of different parts of such, no matter whether these be continuous or separate, united or divided, an aggregate, collectively taken, forms what is called quantity. A quantity of any such attributes or parts is deemed great or small, relative to any other quantity of the same or of other different attributes or parts. Of quantity, as of mere time and space, each portion is intrinsically definite, limited, and incapable of offering identity with any other portion of quantity different from itself. It is only capable of existing in those portions of time and place where a different quantity of the same attribute is not: it is incapable of being where any such other different quantity of the same or other attributes or parts is found. If an entity at the same time and in the same place offer quantities different from each other, it is only of attributes already different from each other. Thus the same orange may at the same time and in the same place offer a very great quantity of what is called savour, and a

very small quantity of what is called sap. Quantity, except where it is of time and space themselves, is not always measured by time and space. Similar measures of time may, of similar modes of movement, according as these movements are slower or quicker, contain quantities very different: similar measures of space may, of the same sort of colour, according as this colour is lighter or deeper, contain quantities very dissimilar: and often the smaller measure of time or of space may contain the greater quantity of movement, or of colour. This constitutes it a poverty in language only to have the same word greatness or smallness for expressing the relative superiority or inferiority in quantity and in size. It feels grating to say that the minuteness of a mite is very great compared with that of a mammoth.

As of time and of space, so of quantity or of any other attribute different from those of time and of space, no portion appears great or small while uncompared with and unmeasured through some other portion of the same attribute. It is only when compared with and measured through some such that it appears either the one or the other. As from the Almighty bosom, of time ever advancing and of space ever growing, new portions must continually be poured forth, so likewise must from the first cause, of quantity and of every other modification, through

the medium of time and space created or made to appear, new portions continually be made to flow.

Where of time, or of space, or of any other attribute or modification included in those of time or space, certain portions, before still united in a single continuous mass, collectively still called one and the same, by degrees become perceptibly distinguishable from each other, they form together number, increasing as often and as much as in the whole aggregate there arise new divisions into lesser portions, each again distinguishable from the others. Of numbers some may be subtracted from others; and to numbers other numbers again different from them may be added.

Numbers may be increased without the quantities which supply them being increased, by those quantities being divided into smaller quantities separate from each other: they may be increased by the former quantities having new separate quantities added to them.

Of certain modifications, whether of duration, or extension, or number, or force or other, the quantity, compared with and measured through another different quantity either of the same, or of any other modification different from itself, and equal to or larger or smaller than itself, is called its proportion relative to that other.

The same aggregate which offers, compared

with a certain other aggregate different from itself, a considerable excess in quantity, may again, compared with a certain other aggregate again different both from itself and from that former different aggregate, present in quantity a considerable inferiority or falling short.

The apple which is large or capacious in proportion to the pips it contains, is small in proportion to the tree which bears thousands of similar apples.

It is a trite but a true observation that between all the modifications physical and mental perceptible to us, different from and opposite to each other, a certain proportion, such as causes the force, impetus, movement and action of each respecting that of the other to be by those of the other respecting itself balanced, is necessary in order to produce in each modification a power of resisting the further advancement of the other; a liability of becoming itself, through the check which the other offers to its own further advancement, equally arrested and stationary with that other; a means of each thus becoming united with the other, and being through dint of that union with the other made to offer new forms and to present new faculties, different from and more complex than those which each singly and separately possessed. Nay it is equally evident that where such balances already have existed and such unions been formed, the addition on both

sides of new modifications balancing each other, will externally enlarge the mass, or internally increase the condensation and vigour of the modifications already united.

It consequently is equally true that if modifications, physical or mental, perceptible to us, different from each other, are, in proportions relative to each other between which this balance does not exist made to approach each other, instead of the two opposite modifications being made to unite into a third, different from either of the former separately, and possessing, with a substance and a form, faculties different from and more complex than those which either of the two prior modifications separately possessed, the one of these two opposite modifications which in quantity, or impetus, or strength, exceeds the other, will not only by the other, less in quantity or weaker in impetus than itself, not be arrested, but on the contrary will drive that other backward before it, and continue pursuing that other, until by the accession of some other force from before, or by some diminution of its own force from behind, the proportions of the opposite modifications relative to each other be altered.

Nay it is equally evident that if, after between two opposite modifications a prior balance have already produced a prior union, on one side later accessions or later losses, not similarly taking

place on the opposite side, again disturb that balance, the union by the former balance produced will again cease; the faculties that arose out of this union will again be annihilated, the forms be destroyed, and the modifications that are weakest be by those that are strongest again driven away and put to flight.

This circumstance already takes place with the opposite quantities of modifications still the most purely physical—with those of mere material force and impulse, which, if equal on both sides, arrest each other and become stationary, or only, instead of each continuing to act as before in a forward direction, each unite with the other and turn aside into a new direction, different from that former one, and intermediate between and transverse to both the former ones.

This circumstance also of substances and bodies first causes the composition, cohesion and solidification, and the again later subsequent decomposition, decombination and dissolution; and this circumstance again holds good with the opposite quantities of modifications even the most complex of mind. If from one side a will of ours is strongly impelled to the performance of a particular action, and if from another side another will of ours, different from the former, is as strongly impelled to another peculiar action, incompatible with the former, it causes these two opposite wills each to arrest the impetus

and to mar the tendency of the other, and to remain ineffective and stationary; whereas, when one preponderates, it again drives away the other, and exclusively ripens into corresponding action.

But of this circumstance neither the earliest instances in mere matter, nor the latest in mind, have yet been attended to sufficiently to draw from the observation of them a principle universally applicable.

CHAPTER VII.

Genera—individuals.

Some people have thought themselves peculiarly acute and logical in maintaining that in the external world—I mean in that world which we suppose to exist outside the sensations and ideas which are all that we perceive of it—there existed no genera, but only mere individuals; that what we call genera are the mere creations of our own mind,—exist only in that mind and nowhere else.

They have confounded with real external genera, such as we suppose to exist on this globe, outside the human mind, the peculiar later pictures and representations of these genera, which we only form in that mind when we abstract and generalise.

If by the word genus we mean the whole collective aggregate of all the portions of a peculiar attribute of matter or of mind, different from those of any other peculiar attribute of matter or of mind again different from the former, which may exist,—no matter whether these portions be all collected together in time and space in a single continuous undivided body and mass, or

whether of these portions some are, by intervening portions of time and space only, or even by portions of other attributes included in certain of those of mere time and space, separated from others; whether the whole genus be collected in a single uninterrupted individual, or whether it be divided among a number of different lesser individuals simultaneous or successive, again distinct and separate from each other; whether, for instance, a plant of a certain description be an unique and singly form both the genus and an individual of that genus, or whether millions of different similar individuals be spread over the globe; continue to appear on it from age to age, and only collectively form the whole genus, —assuredly there are real genera existing in the external world, just as much as there are ideas and pictures of such genera existing in the mind.

And this is the way in which the word genus is meant to be, and is actually, in general by the custom of language understood, when applied to real external modifications; and of these modifications there are some, such as that of finiteness, of limits, of quantity, of proportion and others which, belonging essentially to all matter alike, are every where found to exist in a continuous aggregate, as well in the external world as in the mind of man. But there are others which, like powers of vitality, of sensation, of thought, and of reason,—only belonging to cer-

tain lesser or later genera or individuals,—have on this globe certain of their component parts separated by wide intervening portions of time and space unoccupied by any portion of them, from other portions of time and space possessing other different individual portions of them.

Even of these genera, more restricted however, of which different portions may, on this globe, in reality be divided from other portions of the same genus, and belong to other individuals different in time and place from those to which belong the former portions of the same genus, there may, in the mind of man, by means of abstractions and generalisations, be formed ideas, representations, pictures, in which all that is in the external reality thus separated and divided between different individuals simultaneous and successive distinct from each other, shall, in that mind, be united in a single continuous intellectual whole; which mental whole however, while it is a representation of the external world more concise, and representing more of it in less space and time than any ideas only called concrete can give, only represents those objects more numerous of which it is the image less definitely and detailedly. But this difference between external genera, and the mental representations of certain of them, does not diminish or destroy the reality of the former any more than it does that of the latter.

We shall later see that of the different portions simultaneous and successive of higher genera on this globe in reality separated, and forming individuals distinct from each other, the union in a single continuous whole, of which we can here only form in our mind an abstract idea and representation, a world higher and better organized will probably hereafter present the external reality; that the generalizations formed here will probably only prove anticipations of the state of things we may really expect to experience hereafter; and that thus all the evils which on this globe result from minor individualities, simultaneous and successive, distinct and separate from and interfering with each other, will, in another world, be corrected and removed.

As long as of any genus of modifications all the different portions still remain in time and space so united as only to form a single continuous mass and body, void of interruptions and gaps only filled by intervening portions of mere time and space, or of other attributes different from those belonging to the same genus with the former, that genus is said only to be composed of a single individual; the individual and the genus are said to be one and the same.

But as soon as of a genus certain portions become by certain intervening portions of time and space, not occupied by attributes of the same genus, or occupied by attributes of some other

different genus, separated from other portions of the same genus, that genus becomes singly divided in a number of individuals different from each other.

Of time only and of space alone, the whole aggregate still presents itself to us as a single continuous mass, of which different lesser portions, though in appearance by different later and more partial attributes, resting on these, distinguishable from other portions of the same, and thus far already regarded as different individuals, cannot yet in reality be separated from these others so as to form different individuals distinct from each other, except by means of other different intervening portions of the same attributes of mere time and space.

Of the different globes of our planetary system, by the force of gravitation united in one single body, that gravitation thus already composes a single individual, in its various intrinsic parts united more strongly than are united with these other globes, belonging to other different planetary systems. An aggregate of entire globes may thus, through certain connecting links, form together a single individual as well as an aggregate of the minutest particles of matter; and an aggregate of the most intangible ideas may, through certain connecting links, form a single individual as well as an aggregate of the most solid and cohering substances.

Of a genus, more early and simple and ge-

neral, lesser component parts may each separately contribute their share to other genera more late and complex and partial; but in order to do this they must be added to a portion of some other genus again different from the former. The conditions belonging to and completing a genus earlier and simpler, must be united with the conditions belonging to another genus, different from the former, ere the two can by combination form the conditions of a third genus, again later and more complex than either of the two former ones singly.

We shall hereafter see that, according as of different attributes, forces and materials from opposite sides, only smaller portions are yet made to meet in relative proportions so balanced as to combine together in a new single individual entity, these portions still leave behind them other larger portions yet liable, by a later approach from either side, unbalanced on the other, again to impair the faculties, forms, combinations and existence acquired by that entity, and that only according as of different attributes, forces, and materials from opposite sides greater proportions have met and combined, and only leave smaller quantities still behind, liable again, by approaching from opposite sides in unbalanced proportions, to expose this combination to injury and destruction, the entity becomes more permanently secure from all danger.

CHAPTER VIII.

Power exerted, force displayed, impulse given and received, movement produced.

I HAVE observed before that of powers and faculties already fully possessed, and yet not immediately leading to their manifestation, there can only exist in the mind mere abstract and indefinite ideas; that of such there cannot exist an external reality: that in reality we can only conceive powers, while they remain unexerted, to remain incomplete; that we must conceive faculties, as soon as complete in all their parts, to grow immediately into corresponding actions. I shall therefore, in discussing the origin of powers and faculties, here consider their actual full existence as identical with their positive present exertion.

It has been generally maintained that a power, a faculty, cannot be exerted, a force act, an impulse be given, a movement be produced, except where the modification which produces it is actually present in the very spot where it is produced.

I maintain the contrary.

A power possessed, a force exerted, an im-

pulse given and received, a movement produced, an impression made, imply two objects different from each other, the one active and giving that impression, and the other passive and from the former receiving that impression. These two objects must needs be different from each other in point of place. Force exerted moreover implies movement, and movement implies time in which to perform it. Thence force and movement can only be conceived to exist in portions of time successive, and consequently, like those of space, different from each other. They can only take place in change of time as well as in change of space.

Such power, such faculty, such force cannot originally in its whole derive only from space or time themselves, of which every portion is in itself different from and unconnected with every other portion. It must first derive from something beyond space and time, and able itself, of these attributes of time and space, to embrace and connect different portions together. It must originally derive directly from the very first cause itself of time and space. From that first cause alone can originally emanate, like time and space, that force which, of the portions of time and space before separate and distinct, causes some to act or be acted upon by others, and through the medium of these others.

From the first cause seem constantly to ema-

nate fresh portions not only of time and of space, but also of force, impulse and thus movement, which through time are made to chase these former portions of the same attributes of force, impulse and movement further before them, and more inward in space.

If on the one hand I cannot believe that force can first only originate in later and more internal points of time and space; if I find myself obliged to ascend for the origin of that force to the most external points of space—to the first beginning of time—to the very first cause of space and time itself—I cannot on the other hand conceive of this force the further impulse and propagation to be any where in points of space more late and in points of space more internal stopped or suspended, so as only athwart intervening periods of time or portions of space unoccupied or untraversed by these, and distant from those that are thus traversed, again to be as per saltum revived, propagated and transmitted to other points of time and space still more late and distant.

I can only conceive force to be, through the medium of earlier intervening portions of time contiguous with later portions of time, and through intervening portions of space more external contiguous with portions of space more internal, insensibly from these former transmitted to these latter; or to be, when in its progress by the resistance of an opposite force stopped

and rendered incapable of advancing farther, by fresh pressure from behind made to accumulate on the spot, or by pressure from before made to retrograde backward, till it again approaches the boundaries of space. I can within the boundaries of space conceive force to be concentrated, or diffused, not lost.

When force from stoppage by opposite force, and from consequent stationariness and accumulation, is again at a later period in time released and left to advance, it again from the very identical point in space where it had been arrested, and where until its liberation it had pressed upon the opposite force unsuccessfully, starts and rushes forwards.

I can only conceive force as first on all sides by the Almighty, through successive portions of time, from the more external circumference of space pressed inward into internal portions of space more contracted, and there by its condensation gaining in strength and impetus what it loses in extension. Nay, I can only imagine all force, all impetus, all movement, in the first state in which it is from the first cause through time emanated in space, to be emanated in a more radiant shape; that is to say, in a straight direction in less time advancing to a greater distance. Indeed all force, as from a wider external circumference in space it more approaches its centre, also through greater condensation is made to

show greater intensity, and in less time to take greater strides.

I can only see force, as on every side from behind through space more external and capacious it is pressed forward and inward into space more narrow and confined, ever moving on with greater impetus and rapidity, till by some other force, from another side impelled in space, it is so met that each portion from the opposite side resists the further progress of the other opposite portion.

When this circumstance happens, the peculiar direction in which the opposite forces are made to approach, and the peculiar quantity and proportion in which each meets the other, will cause further consequences very different.

If they meet in a straight line and in equal quantities face to face, each will by its progress forward entirely arrest the other, and be by the progress of that other itself arrested and rendered stationary. If they meet in a straight line, but in unequal quantities, the one whose impetus preponderates will cause the other, whose strength is less, only to be deflected from its straightforward course, and made to turn sideways in a certain greater degree, while itself is on its part by its opponent also made to give way in some degree; or the one whose impetus is strongest will force the other wholly again to retrograde, and to retrace its former steps backward, while itself continues to advance in its original course.

Thus radiating forces, by other forces radiating or more condensed and stationary met, are refracted or reflected.

If opposite forces meet in quantities and proportions equal, but at an angle, and in an oblique direction, the oblique pressure of each on the other will become blended with the oblique pressure of the other on itself, in an united pressure forward, different from and intermediate between that of either of the former separate pressures; moving in a direction from whence the resistance from without is less than that which each pressure singly intrinsically presented to the other. As the pressure from either side preponderates less or more over that from the opposite side, the angle which the two jointly on meeting describe, and the prolongation of the direction produced by that angle, will deviate less or more from the direction in which the opposite forces first advanced and met.

In the same way as forces, from the outskirts of space impelled further inward to its centre, by greater condensation in less time and space acquire more intensity, they will, when from the centre of space they are, by other opposite forces there meeting them, again made to recoil and to be repelled outward and backward towards the circumference of space, again by greater diffusion in time and space diminish in strength, and become more weak and slow. It is, however, probable that forces, once poured into

space, are ever, through dint of new forces, by the first cause continued to be poured in after them, prevented from again entirely escaping from space.

As forces must each singly occupy a certain portion not only of time but of space, and thus can only each individually in the same portion of time exist in a portion of space where the other exists not, where two or more radiant forces are from opposite points of space so impelled as to cross each other, they must necessarily each in its turn advance athwart, and give way to the other, and consequently with that other produce an oscillation, a pulsation, a see-saw of arrestation and of progress.

That force which is strongest will pass on, and in its passage arrest the weaker one, which, while the former, pushed on, gathers by no accumulation any increase of strength, on the contrary itself by stoppage and accumulation from behind gains additional strength, till it again in its turn preponderates over, and arrests, and passes athwart the former. But in forces still radiant, these alternations are still performed in divisions too minute, and with a rapidity too great, to become perceptible to us otherwise than through the pulsations which they cause in time and space.

I believe that time and space being the first and most general of created modifications perceptible to us, it was only through the medium of portions of time and of space combined in

certain relative proportions, that the first cause composed or rendered perceptible modifications of force, impulse and movement, which, in fact, as in more or less time they pervade less or more space, remain less or become greater.

I believe that of the forces, by the first cause in time and space produced, that called of gravitation—not, as we shall see, a force of attraction but of propulsion—to have been the earliest, because it seems to be the most extensive and universal: and thus to have preceded, not only that force and impulse from opposite sides which causes the feel of cohesion, of solidity and of substance, but even that force which, causing the feel of electricity, is after the force causing the feel of mere gravitation itself, the radiant force still most early and most general which we can perceive; and because I do not see how, within the earliest modifications of mere time, and within the most external modifications of mere space, could arise modifications of electricity; and how within modifications of electricity again could arise modifications of positive cohesion, solidity, and substance; and how, in time and space, these modifications of electricity and of substance could be made to perform movements more partial than those of mere gravitation, otherwise than through the medium of gravitation itself,—as we shall explain in the following chapter.

CHAPTER IX.

Gravitation, the earliest and most universal of forces known; a force not of attraction, but of propulsion.

The force of gravitation is generally described as a force of attraction; or a force which, first proceeding from a peculiar object, draws another different object from a distance to that first.

This I do not believe to be the case, and for several reasons: because, if it were the case, firstly, the force of gravitation, originally issuing from a peculiar body which draws another different body to it, would, whenever in its course forward or backward it crossed the course forward or backward of another different force of gravitation, issuing from another different body and drawing another different body to it, interfere with this other force; an inconvenience to which the movements of the different heavenly bodies, made by agencies of different gravitations to tend to each other, seem not to be liable.

Secondly: the force of gravitation, first issuing from a peculiar body, and next attracting another distant body to that first, must singly act in two directions opposite to each other; first in one direction from the object distant from another,

which was to attract that other, till it had reached the same, and next, from that other distant from the former, when reached, again back towards that former, in order to bring the second back to the first; and must act in these opposite directions, not successively, and by pulses, syncopes, see-saws and movements alternately advancing one way and the other, but simultaneously, and so that the opposite movements should at the very same time, in the very same place, advance in these two opposite directions—a thing absolutely contrary to the simplest perceptions and evidence of the sense.

Thirdly: the force of gravitation, if this was the way in which it made one body approach another, would not, after it had produced that approximation between two opposite bodies with ever-increasing celerity up to a certain point, again, beyond that point, before the two opposite bodies had been brought in positive contact, somewhere cease to act; whereas, on the contrary, after it has made the two bodies approximate to a certain point, it not only leaves them, as by magic, again to stand still, but even again to fly away from each other.

Fourthly: the force of gravitation, if it proceeded from a mass attracting another mass towards it, must in each mass be strongest at that part of the surface nearest the other mass where it had the greatest quantity of its own substance

in its rear to be backed by; and must thence go on diminishing across the diameter of that mass till it reached the opposite side of its surface, where, the substance again ceasing, the attraction exerted by it must likewise entirely cease; whereas on the contrary, in each globe to which any other globe tends, the force of gravitation is made from every side alike to increase and to compress substances with an increasing intensity, as from the surface we advance nearer to the centre, till at that centre the intensity and pressure is greatest.

Fifthly: the force of gravitation must, instead of leaving on each globe the substances nearest its surface to cling round its centre,—thereby rendering each globe a body distinct and separate from other globes, and making the tendency of each globe to another globe appear first to begin as it does from the centre of each,—in this case, on the contrary, first begin to show itself by acting from the very surface of each different globe, and where it is nearest to the other next globe; and make of that very surface every minutest particle detach itself from the remaining mass behind it, in order to rise, to advance, and to meet half way the particles of substance, from the other opposite globe equally drawn and made to rise; so that each separate body should, by the attraction of the others, be finally destroyed, and that gravitation, instead of being made to

form masses and globes distinct from each other, should only of distinct globes, in the intermediate space between them, cause the substances again to be confounded and made to return to their original state of chaos.

Sixthly: because it is only, as we shall further more explicitly show, where between different particles of substance is previously found to subsist that cohesion which is only the later and more partial effect of opposite pressures, not only of the force of gravitation, but moreover, within the force of gravitation, of that of electricity, that, through the medium of this cohesion, objects themselves previously moved forward can really and literally drag other objects, in the way of attraction, after them; and because even all the movements arising in the mind that are called effects of attraction, are only in reality the effects of a prior impression which the entity attracting makes by propulsion, and which impression, again, from within the object attracted, by its recoil, produces an impulse outward to the object attracting;—and because thus real attraction only is of matter one of the latest and most partial and most internal modifications, whereas mere gravitation, in its earlier forms, acting from the earliest periods of time and the most distant points of space, already seems to be of that matter one of the earliest and most general attributes.

Seventhly: because wherever between certain

objects situated at a distance from each other we find produced in a certain direction this cohesion just mentioned,—the only medium of real positive ascertained attraction,—it must interfere with and prevent any other attraction acting in a different direction from crossing it; whereas the tendency by one portion of gravitation to one object given is not by a tendency, by another gravitation to another object given across the former, ever annihilated and destroyed.

And, eighthly and lastly: because, if the force of gravitation were a force only first found to inhere in masses of substance, when forming a distinct body, and not already existing before such bodies were formed, and itself first forming such, it could not account, in a satisfactory way, for substances previously incohering and diffused in space being first by it made to conglomerate, and next to grow, before they were lastly by it driven and made to wind round others; nor could this phenomenon, thus left unaccounted for by gravitation, be accounted for satisfactorily by any other power; whereas, on the contrary, if we suppose the force of gravitation, instead of being at best a force of attraction, which, only after globes were formed and finished, first from their general mass began to act outwardly in an incomprehensible manner on other globes, on the contrary to be a force of propulsion which in time and space, long even before globes

were first commenced, already from without, of the materials of such future globes thus far still diffused throughout space, caused certain portions to be first separated, gathered up, propelled toward, collected and conglomerated round distinct centres in distinct bodies, and there by the force of gravitation first made to appear as minute points, next to grow, and lastly, from the same gravitation, to receive the impulse that causes them to move forward and to wind round other globes, all the difficulties of the subject, from that of the first origin in space of substance still unconglomerated, next of the first conglomeration of these substances in globes distinct from each other, and next of the movements by these globes performed relative to each other, to—last of all—those of the very development on this globe of ours of substances merely inorganic into substances organized, sensitive, and intellectual, alike vanish at once, the veil of nature is withdrawn, and each of these different successive phenomena only appears a natural consequence of the original conditions of gravitation.

Nor is it at all indifferent, but of the highest importance to science, to secure to gravitation the acknowledgment of this its legitimate character, which transfers it from the rank of an attribute of matter, only showing itself subsequent to the aggregation of substances into solid globes, to the rank of a condition coeval with

the beginning of time and space themselves; and the medium, in time and space, of the first formation of all substance, all cohesion, all conglomeration of substances into solid bodies and globes, and into all else that on those globes to inorganic matter adds entities organized, living, breathing, feeling, and thinking.

CHAPTER X.

The force of gravitation in reality a force of propulsion.

GRAVITATION, thus wholly unable, as we have in the former chapter seen, to be a force of attraction, can only be a force of propulsion, originating immediately in the first cause, and by that first cause through the medium of time poured into space.

Had the Almighty through the medium of time only propelled portions of gravitation forward in space in a desultory manner, confusion would have been the only consequence. Even had the Almighty through time propelled gravitation forward in space in a more regular mode, but only in parallel directions, earlier portions of gravitation could only have fled before later ones, and later ones could only have pursued earlier ones through space, without any material result whatever deriving from the chase,—without any rays from opposite sides meeting, and by their mutual pressure producing later condensation, distinct form, &c.

But the Almighty, from the outskirts of space

first on all sides causing rays of gravitation to advance to the centre of that space, and causing former rays emanated ever to be by new rays poured out after them driven on, the rays of gravitation, as from the outskirts of space they were driven to its centre, would first in equal quantities become in lesser portions of time and space so much more condensed, as to acquire, relative to the extent and duration they occupied, greater impetus and velocity.

Had rays of gravitation, when from the opposite outskirts of space they were near its centre made to meet, there all met so regularly that those coming from each side were completely arrested by those coming from the opposite side, they could only, while constantly accumulating from behind and arrested from before, have formed a single ever-increasing mass, condemned to be stationary and quiescent during the remainder of time.

But it seems this was not to be the case.

Of rays of gravitation on one side from the outskirts of space propelled inward, many at the centre of space by the rays propelled from the opposite side not arrested, were allowed to traverse that centre, and from converging inward till they reached it, were again beyond it allowed to diverge outward; so that of rays from the outskirts of space converging to its centre, and, as they approached the same, acquiring greater

condensation, intensity, and rapidity, many would, after crossing that centre, and beginning to diverge outward to the opposite portion of the circumference of space, again in more room become more diffused, slower and weaker.

Of rays of gravitation, on one side from the outskirts of space propelled inward, others would at its centre, by rays coming from the opposite outskirts of that space, be met in such equal quantities as there to be arrested by these others and to arrest them, so as with them to form an aggregate of opposite forces becoming quiescent and stationary, which would ever from behind, by fresh forces pouring in, and joining, and accumulating round the former, be increased and extended.

Finally, of rays of gravitation, on one side from the outskirts of space propelled inward, others again would, nearer to its centre, or at distances smaller or greater from that centre, by rays from the opposite side poured into space be met in such unequal quantities and with such unequal strength, that a part of these would again by another part be made to recoil and retrograde in directions more or less approaching those from which they first had come, and would, in these backward movements, by those that had repelled them, be pursued.

So that out of the rays of gravitation first from the outskirts of space converging to its

centre would in more than one way be made to grow rays of gravitation again from the centre of space diverging to its outskirts. Gravitation impelled in a centripetal direction would in more than one way produce gravitation propelled in a centrifugal direction.

But the rays of gravitation from within diverging outward, ever by fresh rays of gravitation from without poured into the same track met and opposed, would partly again, by the pressure of these latter upon them in their retrograde course, be from their first direction outward so deflected as, from being first from the general centre of space made to diverge outward to its general circumference, at a further distance from the same centre again to be made to converge inward to some secondary lesser centre, situated at a distance beyond the first, and between that first and the circumference of space, where, by fresh gravitation from without radiating inward met, they would with the same produce a secondary focus of gravitation, first centripetal, and next again by recoil from opposite sides also becoming centrifugal.

And wherever, between the general circumference of space and its general centre, of the rays of gravitation from that circumference propelled to that centre, certain portions met portions of the gravitation from the centre of space again radiating outward, the two would mutually

so arrest each other as together to produce one of these secondary smaller nuclei of gravitation, first converging and next also diverging, here described; so that, while the first and more central nucleus itself was still, by fresh converging gravitation from the circumference of space, made to grow and to increase, partly from the continuation of that same converging gravitation, and partly from the later gravitation from that central mass again made to diverge, there would arise round it, in different points of space situated nearer to the circumference of space, other lesser and later nuclei of gravitation centripetal and centrifugal in numbers beyond all calculation.

From these secondary nuclei the radiations outward, again catching and deflecting and arresting still further radiations from the general circumference of space first propelled to its general centre, there would again arise between that general centre and the secondary nuclei, and between the secondary nuclei and the circumference of space, other nuclei of a third order, and others still later and less, so that we can conceive no limits to the creation of heavenly bodies out of others earlier and more central, as long as the Almighty power continues to show, by the continued impulse of gravitation, that it pours forth fresh portions of that force into space.

Of gravitation both converging and diverging

the first great central nucleus, experiencing from all sides around a pressure even and balanced, would retain a situation fixed, motionless, and stationary; but of the other later and lesser nuclei formed round it, each receiving both from the circumference of space and from its centre opposite pressures indirect and oblique relative to each other, would have their more external parts driven and made to wind round their more internal parts, in the direction in which the pressure preponderated: and this oblique pressure preponderating on the side next the circumference of space, and being nevertheless, by the resistance of the centrifugal force from within, prevented from causing the later nuclei to collapse on the earlier ones, would only make these later ones to their rotation round their own centre, or rather, round an axis of their own, add a progressive motion such as would make them wind round all the prior nuclei in which they partly originated, unto the earliest, innermost, and largest of them.

Should, however, on the one hand, by the cessation of further gravitation converging from without, the gravitation from within diverging outward for a time predominate, it would push all the secondary nuclei themselves outward, till they were again from situations nearer the centre of space made to reach its outermost circumference; and should, on the other hand, by the

cessation of diverging gravitation, the converging gravitation alone acquire paramount sway, all the different secondary nuclei would be made to collapse on the first and most central one.

At the peculiar point in space where later gravitation from without converging, with gravitation from a prior nucleus within diverging, first met in quantities so preponderating over those of the latter, as to begin causing in the new nucleus it produced a rotation round the former nucleus, that preponderance would probably ever after continue so much greater than the preponderance of the gravitation of a converging sort influencing the remaining portion of the orbit of the secondary nucleus round the more primary one, that whenever, in its successive rotations, the secondary nucleus approached that point, it would be pressed nearer the former nucleus, and more overcome the diverging pressure it experienced from that former, than it did during the remainder and the opposite extreme of its rotation; and would thus in that rotation more from a perfect circle deviate into an ellipsis.

New converging gravitation ever poured into space, and ever producing new later diverging gravitation, would ever press the later secondary nuclei outward to a greater distance from the first and from each other; so that while each nucleus singly increased in individual extension,

the whole collective mass of nuclei would do so likewise.

Of the gravitation from the secondary nuclei nearer the circumference of space diverging, a part would find its way inward into the first and most central nucleus, and by its uneven pressure from different sides on the same, produce in it some oscillation and movement, though small compared with that by these later and more partial nuclei themselves experienced.

Where nuclei of gravitation converging and diverging produced round them other nuclei, made to wind round their parents, but not afterwards to kindle up with, and emanate from them that light with which again shone the lesser and later nuclei in their turn formed around them, they would themselves from a distance remain invisible, and their later offspring alone, lit up and visible, would appear destitute of a common link and centre.

Nor is this all. From the general circumference of space certain rays of converging gravitation would fall or stray into what we should call the lost corners, intervening between the circumferences from whence spring the converging gravitations of a secondary sort, co-operating in the production of the secondary nuclei; and these rays would, with rays of gravitation from these secondary nuclei again diverging outward and made to penetrate into these lost corners,

form a third order of nuclei of gravitation converging and diverging, less regular, less condensed and less evenly resisting further pressure from without than any former ones. Thus showing with less condensation less regularity of form, the latter nuclei would also display round other nuclei more regular, movements and rotations more eccentric, more uneven, less steady and less regulated; and while the former nuclei were only driven round others to which they owed allegiance, in ellipses little deviating from the perfect circle, and less deviating from a course in the same direction, these latter nuclei would be driven round those on which they depended in parabolas so elongated as often to appear at one time quite to fly away from the very same nuclei which at others they threatened with positive contact and collision, and would round these ruling nuclei be driven in directions wholly opposite to those of others.

The force of gravitation—the first force which out of the union of portions of time with portions of space arises, and which from first being merely converging in part again becomes diverging—seems, after time and space themselves, the first medium, agent, material and mover of all other combinations and decombinations later and more partial; from those of electricity—both that called positive, and that foolishly enough called negative—and those of cold and of heat, to all other

forces and substances, combinations and decombinations, perceptible to us, by these prior forces again in their turn produced and influenced.

After later gravitation has, by its combinations, produced entities possessed of instruments and powers of sensation, that gravitation, when from points in space without situated above these organs, it directly or through other media falls on and presses them downwards in a centrifugal direction, produces in them a sensation of gravity or weight; and when, on the contrary, from points in space without situated underneath those organs, it rises and presses them upwards in a centripetal direction, produces in them the opposite sensation of lightness or buoyancy.

CHAPTER XI.

Of some of the attributes and conditions belonging to the earliest and most universal force—that called of gravitation,—proofs à posteriori.

THAT the force of gravitation already may, without the medium of any intervening solid body in immediate contact with another solid body, impel that other solid body forward, is seen in a billiard ball, which merely by its motion may accumulate gravitation before it in sufficient quantities already to begin propelling another billiard ball situated at a further distance, and thus far stationary, before it in the same direction with that in which it is itself impelled; and is again seen in a ball which, propelled from one side to a solid wall, impeding the further advance of the gravitation driven before that ball, may, even before that ball reaches that wall, by that gravitation again pressed and dilating from the other side, be made to recoil and rebound backwards.

That the force of gravitation is elastic; that when a portion of it advancing from one side is from the opposite side by another portion of it more powerful, pressed upon, its quantity is by that pressure condensed in less space; and that,

when from the opposite side that other portion is removed, the same quantity again spreads over a wider space, appears, since firstly, when of gravitation the lateral pressure outward is on one side by the intervention of high mountains stopped from extending farther, that gravitation existing on the other side of and beyond these mountains, is left to dilate towards them so much more than it does in points of space where it meets with resistance and counteraction, as to make the plummet, instead of being from all sides pressed down to the globe in a sense alike perpendicular to it, from the side where interfere these mountains visibly incline towards their mass; and since secondly, where the force of gravitation drives a detached solid object either from on high downwards to the solid earth, or from one side forward to another solid surface, so that the gravitation intervening between this detached solid body and the solid surface beyond, itself unable to retreat farther backward, is by the movement of that detached mass forward and by its own resistance and stationariness, compressed in less space, it acquires by this greater condensation so much greater force as, when the detached and moving solid body has reached, or nearly so, the stationary solid surface, again to make that gravitation by the resistance of the surface from behind dilate in front and towards the body moved, till its dilatation make that moveable body rebound backward to a certain distance,

and allow the recoiling gravitation room to escape sideways from between the stationary solid surface and itself, before that body, even where by its weight falling a second time, is thenceforward made to lie still where it alights.

That the force of gravitation, as from space more extended it is in equal quantities compressed into space more contracted acquires, by compression and condensation, greater intensity and velocity; and that again, as from space more contracted it is in equal quantities left in greater space more to dilate, it loses by that dilatation more of its strength and velocity, appears, since on the one hand the gravitation from a wider and more distant circumference falling on this globe, the nearer it approaches its centre, the more also, from greater condensation it increases in rapidity and pressure; and since the opposite gravitation from a more contracted focus rising to a wider circumference, the higher it rises, the more likewise, from greater diffusion, it loses of its strength and rapidity.

That of two opposite portions of gravitation, from two opposite extremities made to meet, each, by the degrees of extent, quantity, force and impetus which it possesses and exerts relative to the other, has its further movements in conjunction with those of the other ruled, appears, since according as the proportions in

which each presents these conditions relative to the other, one of the two is by the other repelled and pursued; or each joins that other in a new direction, intermediate between and at angles greater or less relative to its former direction and that of the other.

That gravitation of a centripetal sort, from a wider external circumference converging to a more confined internal focus, when by an opposite converging gravitation arrested, repelled, and made to recoil, with that other produces a later gravitation of a centripetal sort, from a narrower internal focus again diverging outward to a wider and more external circumference, appears, since, after converging gravitation has from on high made vapours descend till round the earth they collect and condense in clouds, the centripetal gravitation again from the earth recoiling, keeps these clouds at a certain distance from its body suspended or rather supported over the same, without approaching nearer; and since, even after converging gravitation has from on high driven fluids down till they be in their further lapse by the solid earth arrested, they will, by later gravitation from that earth recoiling, again be made to rise to a certain height above its surface, as we see in jets d'eaux; and since, where centrifugal gravitation from on high driving fluids down is by solid bodies interposed between this gravitation and the earth, so arrested

as only to make these fluids reach the upper side of these bodies and there remain, the centrifugal gravitation, from underneath recoiling upward, is by this arrestation of the converging force from on high left at liberty to act with so much more power than before, as to drive other fluids from the earth upwards, till they are arrested by and made to cling to the undermost surface of those very intervening solid bodies, of which the upper surface arrested the fluids from on high; and since gravitation, from the outside of a hoop by its rapid circular motion so drawn in, as by recoil from its prior converging and centripetal direction to be within that very hoop again driven outward in a centrifugal direction, will drive and press a glass filled with water outward till it reach the inside surface of the hoop, and during all the later successive circular motions of that hoop, sufficiently rapid to keep up this pressure from within, while from without the further divergence of the glass of water is stopped, continues pressing the cup and making it cling to the inner surface of the hoop; and since a solid body, by centripetal gravitation from on high driven to the solid surface of the earth with such impetus and velocity as not to let the force of gravitation, intervening between itself and the earth, escape sideways before it be greatly compressed, will again, by the subsequent dilatation of that intervening portion of

gravitation, be made to rebound to a certain height before that intervening gravitation, by making its escape laterally, leaves the body a second time to fall to the ground without again rebounding; and since a solid body, by side-long gravitation cast forward laterally in the same way till the gravitation intervening between that body and a solid wall be compressed in a very small space, will equally, by the subsequent dilatation of that compressed gravitation, increasing in proportion as the pressure from behind on the moving body by dilatation becomes weaker, again makes that body rebound. And since where gravitation of a centripetal sort has by narrow tubes its further descent and pressure downwards so interfered with, as to leave gravitation of a centrifugal sort ascending from the earth, when ascending through these tubes, more unobstructed play, this gravitation of a centrifugal sort forces liquids through these tubes upward, by what is erroneously called capillary attraction, in a direction opposite to that of centripetal gravitation; and since, where of tubes even wider than those already calculated to disturb the straightforward movement of converging gravitation, the aperture from above is by a solid body protected from the influx of that gravitation, the centrifugal gravitation from underneath attains in these tubes an unimpeded power so much greater still, as even to force up in them large columns of fluid;

as we see in pumps; and since heavenly bodies, from great distances by gravitation driven towards others, when approaching nearer to these others, are again by opposite gravitations from them proceeding outward, repelled and made to retrograde; and finally, since round Saturn we see a solid ring detached from its body, which yet during the movements of the planet is constantly, by the gravitation from its nucleus radiating outwards, on all sides equally repelled, and on all sides kept at an equal distance from its surface.

We shall now proceed to see how the force of gravitation, thus by the first cause out of combinations of time and space first formed, in its turn became the medium of the later and more partial force of electricity.

CHAPTER XII.

Cold not a mere negative attribute,—not the mere absence or subtraction of a certain portion of the positive attribute of heat, but itself a positive attribute distinct from, and contrary to, and often growing simultaneously with, and by the very side of, and positively conflicting with the positive attribute of heat itself.

I THINK I have exposed one error, which, if left unmolested, would have impeded my progress toward truth,—namely, that the force of gravitation is a force of attraction. I have shown it to be a force of propulsion. I shall now pass over to exposing another error, which will otherwise also soon stand in my way,—namely, that cold is a mere negative attribute: the mere absence or subtraction of a certain portion of the positive attribute of heat.

Cold, that force which at a certain degree of intensity causes substances, from thus far being merely radiant to become gaseous, liquid and solid, and which, when acting on substances and bodies of a sentient sort, produces in these, while increasing their solidity, a peculiar sensation, ac-

cording to its degrees, pleasant or painful, has long been considered as the mere diminution or absence of the positive modification of heat; only because, in general, when heat any where increases cold diminishes.

But this circumstance is no proof whatever in support of the idea in question. Two forces, two attributes, two substances, nay, two bodies, may be so incompatible with each other in the very same portions of space, that in that identical portion of space a certain quantity of the one necessarily excludes the smallest quantity of the other, and yet both may be equally positive; nay, each equally thrive in the nearest vicinity to the other.

Who will assert for instance that two colours wholly different, such as red and blue, though they may be intermixed so closely that the impression of each singly on the eye cannot be distinguished from that of the other,—that they shall jointly produce on the eye the mixed impression only of purple—are not each separately as positive as the other, and yet who shall not at the same time deny, in consequence of that very positiveness of both, that either can possibly at the very same time be in the very same place with the other?

And is it not the same with every other portion of every other positive attribute of substances and bodies?

It has been asserted that cold is the mere absence of heat, in the same way as darkness is the mere absence of light.

But the two cases are not parallel; and here precisely lies the difference, that what we call darkness is the mere absence of the attribute of light, or what we might call a mere negative attribute; and, while removing the impressions produced by light, substitutes immediately no other positive different impressions in their stead: whereas what we call cold is not the mere absence of the attribute of heat, or what we might call a mere negative attribute; but, while removing the impressions of the positive attribute of heat, substitutes other different impressions, as positive as those of heat themselves, in their stead.

If during darkness there arise ideas and feelings not apt to visit us while there is light,—such for instance as fears of ghosts and hobgoblins,—these are not the direct offspring of darkness itself, but of the room this darkness leaves in the mind for visions which the light of day, and the more cohering objects it shows, exclude. Darkness directly produces no sensation whatever, whereas cold does.

The idea, erroneous and unfounded, of cold being a mere negative attribute—a mere diminution or absence of heat,—can only be reconcilable, and seems connected with, the other idea equally erroneous that the primitive state

of all created matter, in the earliest periods of time, and in the most external as well as more internal points of space, was a state of entire cohesion and solidity; that only at later periods, through dint of a supervening positive force called of heat, of that matter, before solid throughout, certain parts were released from their original state of cohesion and solidity, and rendered more separate and more expanded; that thus, as the mere force of heat, by subsequently supervening, had caused matter from solid to become fluid, gaseous and radiant, the mere removal of that heat again sufficed to leave matter to relapse in its original state of cohesion and solidity.

Were cold a mere negative, not a positive attribute;—were cold, and the condensation of matter resulting from it, by the mere extinction of heat carried to its maximum,—that maximum must not only again take place afresh wherever heat again totally disappears; it must have existed universally in matter, before in that matter arose any particle of the positive attribute of heat whatever. In the first periods of the creation it must have enveloped, have torpified all. It must have rendered all that is perceptible a mass of unmixed solidity, impenetrability and cohesion. Only by degrees would there in space, with the arising of heat, by the melting and dissolution of some portion of this solid mass, have arisen some portion of partial fluidity, gaseousness and

radiance—some open space, some void, some breathing-holes: and it even remains inconceivable how in such a solid mass any heat could penetrate and make its way, and produce these intervening vacua.

But in the beginning of time and space we can as little suppose any cold, any condensation and solidity, as any heat, any dissolution and fluidity, to have existed. The more we look around us the more we are convinced to the contrary; the more we are led to infer that in the beginning of space and time all was universal diffusion, looseness, absence of pressure, of resistance, of gravity, solidity and cohesion; that there was not yet that medium which produces the effects and feelings of cold, as there was not yet that other medium which produces the effects and feelings of heat; that only in certain portions of time less remote, and in certain portions of space more internal, through forces first radiant of gravitation, of electricity and of cold, other forces, first likewise radiant, were first condensed in gases, liquids and solids.

And to this very day, of space how many portions, even more inward and more partial, seem still to remain in a state of pure radiance, and destitute alike of positive cold and of positive heat.

Moreover, if cold were a mere negative attribute—if cold and the condensations it causes

were the mere effects of the absence of heat, and of the dilatations by heat produced, it would only, as heat increased and extended, quietly and without bustle diminish and disappear, and leave the field to heat; and when that heat itself again in its turn retired, cold would again spontaneously resume its former possession but, like mere gravitation, leave substance, by the former heat distended, again quietly to collapse in incohering matter. It could not erect its crest in opposition to that of heat itself; present itself to heat as an equal in might; struggle with it for victory, dispute with it the ground, and at the same time with heat, in portions of space often very small and very numerous, situated next to and intermixed with those occupied by heat, possess its own beginning, growth, extent, duration, locality, limits, pressure, resistance, movements, radiations and other properties, as positive as those of heat itself; and yet different and distinct from, and often contrary to and conflicting with those of heat. Each could not in turns contend for mastery with the other: each could not in turns by superior power drive away from, or compress within it the other, so as to render that other for a time quiescent, without yet causing its annihilation.

Cold could not, if it were a mere negative attribute, a mere absence of heat, where it rose to that degree as to produce frost, and the congela-

tion of substances, compress and condense that heat itself so much more than it did before, as to make a fire burn brighter during frost than it does during thaw. It could not in a body weakened by disease, and having within it little heat wherewith to resist the invasion of cold from without, penetrate so much more freely and copiously and deeply than it does in a body in health, and having more internal warmth to protect it, as in that weakened body to produce the cold fit of an ague, lasting while warmth remains within more compressed, and until that warmth, left torpid within, is by new additions of heat penetrating from without anew so reinforced, as again to dilate, in its turn to drive out the cold before it, and by its own renewed expansion to produce a copious perspiration.

Cold could not, instead of only suffering molecules of substance to collapse in an irregular and desultory way, by the peculiarities of a positive pressure of its own, drive these molecules forward, and compress those molecules that come from opposite sides together in such peculiar relative directions, as when in their tendency to each other meeting with obstructions from other bodies already solid, again to cause these other bodies to burst and to be driven asunder, in order to make way for them, and as themselves, when by that cold their meeting is effected, and their cohesion completed, to be enabled to resist

other pressures and shocks from without very considerable, without being by these again separated.

It could not, after a lump of ice had been plunged in hot water, when by degrees from that water the heat in part penetrates within the ice so as to make it distend and liquesce, make the cold, instead of from the first in the ice entirely disappearing, cause it at first only to be driven to a greater distance and a wider circumference in the surrounding water, itself becoming less hot as the heat has more been left from that water without to penetrate the ice within; and thus, by only making that cold exchange places with that heat, make it form, round where the lump of ice melted, a new ring or zone of ice, less compact and dense than that former lump, before, by the subsequent melting of this zone itself, the cold was gradually suffered from the water entirely to escape in circumambient air.

Cold could not, by its own peculiar movements and pressures on substances, by that pressure condensed and congealed, produce those symmetric and beautiful arrangements of parts, not producible by the mere collapsion caused either by mere gravitation, or by melting of solids, which we already find in congelations by mere cold: those stars seen in snow-spangles, and those ramifications, those arborescences by hoar frost displayed in rind.

Above all, cold could not, instead of only leaving in the organs of sense the feel of heat

diminished or annihilated, as would have been the case were cold only the mere diminution or cessation of heat, itself cause, even sometimes before the feel of heat has entirely subsided, and intermixed with that very feel of heat itself, a feel as positive as that of heat, but wholly different from it, and like that of heat, while in moderation pleasant, only when immoderate becoming irksome and painful.

Now all this, which cold, were it the mere negation or diminution of heat, could not effect, it does effect in direct opposition to heat.

Rays of cold and of heat may each be made so to radiate across the track of the other that neither rays shall be destroyed by their antagonists, but that while those of heat shall across those of cold dissolve ice into fluids, those of cold shall across those of heat congeal liquids into ice.

Often when in muggy weather the opposite radiations of heat and of cold from on high, alike penetrating our dense atmosphere with difficulty, are alike very weak and very diffused, we find in the air, mixed with little heat, little cold; and again, in an atmosphere most clear and sunshiny, and when from on high the radiations of heat reach the earth most copiously, we again feel rays of cold side by side and intermixed with rays of heat, both reach the earth so closely, that while those of heat drive the perspiration from the inside of the body, those

of cold again, at the very exit of the fluids through the pores of the skin, and on the very threshold, arrest and condense these fluids into solids; and that, while rays of heat extract vapours from the ground, those of heat again congeal these vapours at the surface of the waters.

In India, we find ice skimmed from the surface of tanks in a temperature where in England such a thing would be unheard of.

When our body has from surrounding air imbibed a great quantity of cold in a way so gradual as to be, while it remains quiescent in the body, little felt, the sudden approach to a large fire, throwing out a great heat, may of that heat make the streams flow into the body so rapidly and copiously, as, by again setting in motion and driving out the former rays of cold as rapidly, at their exit to produce a chill, a shivering and a trepidation, not felt while that cold retained quiet and undisturbed possession of the body.

And every day we experience some other of those positive effects and sensations of cold, produced so very palpably in the very teeth of heat itself, as to prove that, like heat, cold is a positive attribute, having its beginning, increase, and limits independent of those of heat, but able to exist and to grow simultaneously with heat itself, and to have with that heat struggles, sometimes ending in victory, and at others in flight.

CHAPTER XIII.

The modification productive of the effects and sensations of cold not only is a peculiar modification as positive as that productive of the effects and sensations of heat; and a modification totally distinct from and contrary to the modification productive of heat, but is even in its earliest appearance and origin out of other prior conditions a modification anterior to and more general than the modification productive of heat itself.

In the former chapter I have shown that I consider the effects and the feel of cold as not proceeding from the mere absence of the attributes and effects of heat, but as proceeding from an attribute, a secondary cause as positive as that from which proceed the effects of heat themselves; from an attribute as independent of heat, as heat is independent of cold; from an attribute distinct and different from, and even contrary to that from which proceed the effects and feel of heat; from an attribute of which the increase at the same time with, though in places

different from those occupied by that of heat, is compatible with that of heat itself; though, according as cold preponderates over, or is preponderated over by heat, from a peculiar spot it expel or be expelled by heat.

I shall now go a step farther: I shall show that I consider the effects and sensations of cold to proceed from an attribute which, in its first birth and existence, I regard as prior to the attribute whence arose the effects and sensations of heat.

I shall maintain that since time and space, the two first, most universal and most elementary of perceptible modifications, were first wholly destitute of cohesion, of solidity and of substance; since even of later forces the most universal—that of gravitation—was still at first wholly radiant and unconnected in its parts, before any of its portions were in their radiance stopped, fixed, and rendered cohering and solid: since only by a force of combination a part of these radiant elements and forces must, from that state of universal radiance, first have been reduced to a state of connexion, combination, cohesion and solidity, before it could, from that state of connexion, combination, cohesion and solidity, again have been restored to a state of decombination, dissolution, diffusion and radiance; and since of all forces of decombination and dissolution that of heat is the earliest and most universal, the action

of heat, which decombines, must to a certain degree have been preceded by that of cold, which combines,—must only have succeeded that of cold.

And that this was the case not only induction shows, but experience confirms; for after we have, out of a substance, through means of an air-pump drawn, with all the air it could contain, all the heat it could harbour, we still find the cold, before in that substance by that heat counteracted and modified, now again remaining unmodified and uncontrolled, now also again over that substance exert an exclusive and uncontrolled sway.

At the same time I believe cold itself, like gravitation and like heat, in its primitive state, only yet to be, not only a mere radiance, but a mere force, which, after being itself from certain other radiations and forces first separated, can by these others again be made to grasp, and weave itself round, and compass, and compress and condense certain other radiant forces, and from their being radiant, moveable, yielding, and imponderable to us, render these more dense, and fixed, and resisting, and ponderable, and palpable, and visible; because I have never seen cold become intrinsically so condensed as to become directly, in itself, and independent of some substance on which it acted, palpable, ponderable, weighty or visible; because I have only found the sub-

stance itself on which cold acted to become thus gradually palpable, ponderable, weighty, and visible; and because even the sensation of cold only arises in the body, where in the same that cold meets, and condenses, and torpifies the peculiar fluid which flows in the nerves susceptible of that sensation.

CHAPTER XIV.

The modification productive of cold is not only a peculiar modification of a positive sort, prior to that productive of heat, but is the first modification produced by, and in which shows itself the force called of electricity.

I BELIEVE the radiant force called cold, which, when itself still comparatively weak, diffused and yielding, lets other radiations pass unarrested athwart its mass, and remain imponderable, impalpable, and fleeting, and when itself becoming more strong, dense and resisting, is able to arrest and condense certain of these other radiations, so as to render them ponderable and palpable, stationary, cohering and solid, to be the first and simplest modification or form assumed by electricity—to be electricity itself in its simplest shape; because, firstly, in those upper regions of space, the most roomy that intervene between different globes or worlds,—those in which electricity, from less interference of and remixture with other forces and substances even still radiant, like those of heat and light, only left to make through their expanse from globe to globe a hasty transit, itself still remains most pure, primitive and unalloyed,—cold still reigns most

generally, constantly and powerfully; and in those lower regions where electricity finds substances on which to act, cold moreover acts on these substances most generally and permanently, —witness the snow there produced and thence unceasingly cast on the highest summits of the highest mountains; the hail thence often in the hottest regions of the globe in the hottest seasons of the year dropped on the lower plains; and the intense frost there at all times experienced by those whom a balloon carries thus high: because, secondly, even in the hottest regions of the earth, after we have out of a Leyden jar with the air also pumped all the heat contained in that air, we find the cold that still remains behind, accompanied and supported by the signs of an electricity more powerful and more uncontrolled than before; because, thirdly, only as we approach nearer the poles, where even at the surface of the earth more cold is collected, we see higher up in surrounding air more of those coruscations of electricity which thence are called aurora borealis and australis; and because, fourthly, where the opposite electricities, which we shall presently describe, are best balanced, and produce the atmosphere clearest, brightest and most elastic, there are found in that atmosphere, mixed with the rays of heat that pervade it, rays of cold more dense and copious; while, on the contrary, when by the preponderance of one of those opposite electricities over the other, they so lose their

balance that they separate, and that the relaxing and decombining sort, productive of heat, lapses unmixed to the lower strata of the atmosphere, and there breaks out in lightning and rain, the bracing and combining sort, productive of cold, again ascends unmixed to the upper strata of the air, and there condenses the humidity it finds into sleet and hailstones; because, fifthly, where substances mineral, vegetable and animal show themselves to be from a state of radiance, gas and liquidity through cold combined into congelations, the movements, the radiations, the shootings, and dilatations, and contractions, and pulses, and vibrations, and crossings in different directions, to which during their transformation these substances show themselves liable, accuse the presence and the agency of electricity; and because, sixthly, when the operation of freezing is concluded, and the substances, before gaseous or liquid, become stationary, cohering, and solid, whether they be solidified, like mere aqueous vapours, in the mere spangles of snow, the mere cubes of hail, the mere ramifications of rind, and the mere sheets of ice, or whether, like substances more complex, they be congealed in forms more varied, mineral, vegetable or animal, they all alike show their component solid molecules intrinsically so shaped, and extrinsically so disposed relative to each other, and exhibiting such facettes and such angularity—such laminarity and such follicles—as evidently refer their formation and arrange-

ment to the agency of that same radiant force of electricity. Nay, I believe all other combinations of substances, before radiant, gaseous or liquid, into cohering solids more complex, more late and more partial than those produced by mere rapid congelation—called combinations and forms mineral, vegetable and animal—still only to be produced by later developments and remodifications of the movements of that very same force of electricity of a combining sort, productive of cold and congelation, because these combinations later, more partial and more complex only differ from that of mere congelation in their degrees: because they are always, like mere congelations, while going forward, accompanied by a certain degree of cold, and, like those combinations by cold more evidently formed, when achieved, offer their more elementary and fundamental component forms still only consisting of those alternations of solid parietes and intervening voids, and producing that cellularity, which in its turn by further aggregation composes strata, laminæ or follicles, such as already in mere congelations arise from the mere movement of the electricity by which these congelations are produced.

Of electricity in its first and most elementary shape,—in that of the force productive of cold, of congelation, and of the sensations resulting from these effects and productions, I shall now show the immediate cause and parent in its turn to be certain modifications of mere gravitation.

CHAPTER XV.

I believe that directly out of certain modifications of gravitation arise the earliest modifications of electricity; namely, those which produce the force of cold, combination, and substance. I believe that sort of electricity which produces cold to be the connecting link between mere force and positive substance.

I CANNOT any where in time and space, outside gravitation, find a modification which is capable of being the secondary cause, or medium or material of that modification more partial which arises in time and space under the name of substance. And were gravitation, as it has been generally supposed, a force of attraction, first from within acting outwards, I could not even in gravitation itself find the connecting link between mere force and substance. I could not find in gravitation those modifications arising out of the former which produce the latter. I could not find in gravitation the qualities requisite to render it the parent of that force which in the present state of science we still only collectively call electricity: thus still making the same term of electricity apply to two forces

wholly opposite to each other;—the one more pointedly called of cold, which first condenses forces into substances, and the other more peculiarly called of heat, which again, after forces have been condensed into substances, dilates and dissolves these substances into mere forces.

But as I have, I hope, proved gravitation to be a force of propulsion from without, I find in certain modifications of gravitation itself the materials of the earliest modifications of electricity; —of the link which, through the medium of electricity, connects gravitation with substance; —of the secondary cause or agent which in space, through gravitation, produces electricity and substance.

I believe within time and space, and within those earliest forces rising within mere time and space, which, whether they still only offer propulsion inward to a common centre, and thus near that centre still occasion a feel of pressure downward to the same, called weight or gravity, or whether they already, through recoil and propulsion outward from that centre, produce from the same a feel of pressure upward called of buoyancy and lightness; alike still may be called forces of gravitation, the force of electricity which produces the effects and sensations of cold to be the offspring most early and universal; because it seems after these modifications of mere time, space and gravitation, within the forces of

gravitation to manifest itself first and most extensively, and to precede, and surround, and embrace the earliest modifications of substance still merely radiant, which afterwards become converted in the shape of the gases, liquids and solids, even the most primitive, general and simple, such as light, colours, and others, thus far in their uncombined state still imperceptible, and only by later combination first becoming perceptible: because all these substances seem only through the medium of electricity first after and within gravitation to arise; and because, after of the gravitation converging and centripetal falling perpendicularly on certain centres, certain portions had again by recoil been converted into rays of gravitation from those centres again diverging and rising vertically on high, when these portions of centrifugal gravitation, in their flight upward, again met with fresh gravitation from on high converging downwards, the portion of each sort, met by a portion of the other, would arrest and be arrested by that other, till by mutual pressure and counter pressure both became alike deflected in their course, and, from each separately moving in a straightforward line, the one ascending and the other descending, would both thenceforth be made jointly to move to the right and left in a lateral line, intermediate between and horizontal to the two former ones, and which, by the superior strength derived from this union of two before

separate and opposite rays, would force its way across the neighbouring ones thus far still only separately ascending and descending; and because that force of electricity, productive of cold and condensation, which seems the most early and general of forces of electricity, possesses all the conditions arising out of these premises—out of this modification of gravitation,—inasmuch as it is a force no longer on this globe, like the earlier and simpler modifications of mere gravitation, only yet moving downwards and upwards, and only directly presenting a strong pressure in these two opposite vertical directions, and not yet presenting any pressure in a lateral and horizontal direction, but is a force which across the opposite pressures of gravitation, descending and ascending themselves, strikes and drives objects forward sideways and in a lateral direction; and often by its superior strength conquers the mere pressure of gravitation from above and from underneath; and as moreover it is a force, no longer, like the earlier and simpler modifications of mere gravitation, only from vast surrounding circumferences moving forward to vast common centres, but, on the contrary, a force from an infinite number of smaller points in space beginning separately to spread outward,—a thing which that electricity, as arising at the same time in points of contact between rays of gravitation converging and diverging very numerous, would

naturally be supposed to do; and as in fact forces of gravitation descending and ascending in a mode very forcible and very complex, and where there arise between them points of contact and mutual resistance very complex and very diversified, actually themselves already produce effects partaking of the nature of those of electricity, as we see in the heat and light which arise out of rotatory motions very rapid.

CHAPTER XVI.

In what respect do, from mere forces, such as gravitation centripetal and centrifugal, and electricity combining and decombining, otherwise called cold and heat, again differ what are called substances.

In general people thus far seem to consider substances as intrinsically wholly distinct from mere forces; nay, as earlier than forces; as the very womb out of which alone forces can first arise,—as the matrix from which alone forces can first come forth.

This idea seems to me to arise from people not sufficiently analysing the nature of force and of substance unto their very first origin,—from their only being struck with the attributes more late and complex which force assumes, after it again later issues forth from substances in a shape more condensed, more distinct and more palpable; and of their not yet being impressed with those conditions still more vague, less definite, which it already possesses, before it has, through the medium of these conditions, wound certain lesser portions of itself first wove and compressed that very substance, through which those portions of

force are again transmitted and made to issue forth beyond it, in that shape more condensed, more complex, more distinct and more palpable, which they there assume.

But we have already, I think, seen that, as well as of mere time and space, so likewise of force and of movement the modifications most early and extensive, those called of gravitation, already seem first to arise directly out of the bosom of what is, or what to us still appears, the yet imperceptible first cause of all the attributes which we can perceive; and that, in its first and simplest perceptible state, force thus as yet intrinsically presents to us no conditions which should prevent its being one of the prior secondary causes or media of the attributes of substance, instead of only being a later and more partial effect of substance. We have seen that later than and within this modification of force called gravitation; and not only later than and withinside gravitation alone, but even after and withinside the modifications of electricity the most early and extensive, already again later and more internal,—those productive of cold, condensation, and congelation,—first appear to have arisen the attributes of elements gaseous, liquid and solid constituting substance, on which those forces of gravitation and of electricity, after first composing them, again acted, and through the medium of which they first in part again acquired a shape

and direction more compressed, distinct and palpable.

What in fact is substance? It is that modification of matter later, more partial and more internal only than portions of mere time, space, and the forces of gravitation and of electricity, from which we again receive, in addition to the sensations we receive from these former conditions only, other sensations of fixity, stationariness, resistance and pressure more definite, more lasting than those which we receive from time, and space, and gravitation, and even electricity, while they still only act unenveloped in and unmodified by attributes of substance.

Examine every thing pointedly called a substance, and it will be found to derive its name of substance only from its being capable of giving, in addition to certain sensations of time and space, and weight or buoyancy, and cold or heat, certain sensations of fixity, of cohesion, of form more distinct and permanent, of resistance to pressure, of pressure on surrounding space condensed in a smaller compass, and consequently, of condensation in the same compass greater than any that can arise from mere unsubstantial force.

But these sensations of substance themselves arise insensibly and gradually out of the sensations of mere unsubstantial force. Substance only presents itself as an attribute of which the most elementary component conditions consist of portions

of time, space, force and movement, and which, if rendered more fixed, more stationary, more resisting displacement from each other than those of mere radiance, still begin in mere radiance, and only derive the conditions in which they again differ from mere radiance, in the radiance which from one side advances being by another radiance from the opposite side advancing, pressed, condensed, arrested, fixed, rendered stationary, and made to cohere with that former; made less liable than that former singly is to yield to pressure even in directions opposite to those from which came their first pressure and arrestation; more capable of, in its turn, making other surrounding points of space yield to its own force and penetration; and more consequently become, what is no longer called merely radiant, but gaseous, liquid, and solid,—what is deemed to possess the full conditions of substance.

And that these sensations of the peculiar conditions of substance, and these peculiar intrinsic conditions of substance themselves from which these sensations arise, at least in part more remotely proceed from modifications of gravitation, after these modifications of gravitation have by mutual resistance, pressure and condensation produced the first modifications of electricity,—namely, those modifications of electricity productive of cold and combination,—and arise more proximately and immediately out of those later modifications of electricity itself, appears, since

that electricity, by conflicting gravitation first produced, would in its turn, when its rays from opposite sides advancing caused fresh rays of gravitation, still going on converging till by each other met and arrested, to be between them caught and compressed, cause these rays from the opposite pressure upon them to derive that increasing condensation, and slowness, and arrestation, and fixity, and cohesion, which from mere radiance distinguishes what are more positively called substances, whether still only gaseous, or already in a greater degree liquid or solid.

Thus it appears that of the opposite forces of gravitation centripetal and centrifugal portions more restricted, internal, and partial, jointly converted into the conditions of electricity combining and productive of cold, through the medium of these intervening attributes of cold again convert other still later portions of the forces of gravitation centripetal and centrifugal, into the aggregates or masses still more condensed and fixed that occasion the feel of substance; and that electricity of a combining sort and productive of cold, is the more immediate secondary cause and agent, through the medium of which, within modifications more early and extensive of time and space and force and movement, by certain portions of these prior conditions, is produced what we call substance.

And that electricity of a condensing sort, and productive of cold, though in itself at first only a mere force—and of a radiant description—is the more proximate parent of all positive substance, appears, since all the sensations which we generally derive in a more definite and palpable shape from positive substances, we already in a certain degree receive from the mere radiating force of electricity, where this force is from peculiar circumstances more than usually condensed and confined.

Mere radiant electricity already, when greatly accumulated, gives to the sense of touch not only feels of pressure, of weight, of penetration, and of buoyancy, more distinct and forcible than those which mere gravitation gives while still unassisted by posisive substance; but, moreover, gives sensations of cold, and, when differently directed, as we shall see, of heat, which gravitation, in its more primitive modifications, gives not yet in any degree: it already to the sense of taste gives certain sensations of flavour alkalescent and acid; to the sense of smell certain sensations of odours sulfurous and others; to the sense of hearing certain sensations of sounds, either continuous or crackling; and to the sense of sight certain sensations of light and of colours—such as high in the heavens above, near the poles, in cold weather and at night are seen in those coruscations, those vibra-

tions, those pulses of light and colour, called aurora borealis and australis; and nearer the earth are beheld in the shape of lightning, shooting stars, and other meteors descending and ascending; and even in a room darkened on purpose are, in electric experiments, witnessed in the form of sparks and streams of light and colours the most vivid; even where there are not any previous positive substances, through the medium of which these phenomena or feelings can be produced in a shape more permanent and lasting.

The force of heat is, as we shall later more explicitly show, a force of electricity still radiant, of which the very beginning—though arising later than the first beginning of that of cold—still out of the radiance producing cold, by the recoil and the contrary direction given to certain portions of that radiance of cold, arises in its incipient degrees almost immediately after the radiation of cold itself has arisen out of that of mere gravitation.

But, as only after cold has by increase produced combinations very forcible, and has, through these combinations produced by it, itself become to us very perceptible, the later decombinations again produced by heat can themselves also become very perceptible, I shall first describe those combinations that on this globe are the effects of the first electric force—

that of cold; and only next describe the decombinations that out of the secondary form of electricity, called that of heat, again in their turn arise, and counteract the effects of the former; not minding that in reality already from some of the more incipient modifications of cold arise some of the incipient degrees of heat, long before of cold combinations later and more complex give opportunities for decombinations by heat more late and complex, more distinctly by us in themselves or in their effects becoming perceptible.

CHAPTER XVII.

Like those modifications that intrinsically to the last remain mere radiant forces, all those other modifications that, by degrees, become more stationary and cohering substances and bodies, gaseous, liquid, and solid, begin by being mere radiant forces; and it is through the medium of the radiant forces of electricity, producing cold, condensation and combination—itself the later offspring of gravitation—that the materials of bodies first supplied by that same gravitation, and themselves merely radiant, are by degrees combined into the later substances more condensed, stationary and cohering, gaseous, liquid, and solid.

People that deal in natural history generally begin by describing objects mineral, vegetable, and animal, in their solid form.

This perhaps may be a method sufficient for the purposes they have in view, but it is not sufficient to give of the origin of these objects a very extended knowledge. It is contenting oneself with only describing, in their last and concluding state and modifications, things which have

many other prior and more elementary forms, on which these last are only subsequently superstructed, instead of beginning by describing these things in the more elementary forms, which are the necessary foundations and preliminaries on which their later shapes are raised. It even leads to the egregious error of considering solids as being in entities the bases and support of their fluids; and of considering particularly, in entities of an organized and living sort, the vessels as the first parts destined to be the receptacles and conductors of those saps, out of the prior composition and course of which, wholly independent of vessels, the very composition and course of these vessels themselves on the contrary first arose.

The fact is, as we shall show, that throughout nature the solids are, in their peculiar direction, form and cohesion, only later and more partial effects of the combination and condensation of liquids and fluids arising prior to them; and that these liquids and fluids again are the later effects only of still prior radiances—as we may partly see in a seed or an egg, in which all the parts are liquid or fluid, before any of them become solid and cohering.

Having already in the preceding chapter shown that mere radiances may be combined into substances more stationary and cohering, gaseous, liquid and solid, we shall now show that all sub-

stances, gaseous, liquid and solid whatever, without any exception, must have begun in mere radiance.

This assertion may, on the first glance of it, appear bold.

What!—will it be said—maintain that, like the modifications which still surround the most distant outskirts of our atmosphere, the materials of the most early and internal and dense and weighty nuclei of our globe—the metals and rocks which, during ages unnumbered have formed its hard, heavy, fixed and motionless core, —have once been pure radiance, capable of traversing in the shortest periods of time, with the greatest rapidity, the farthest regions of space; of spreading in the twinkling of an eye from one extremity of the hemisphere to the other, without being able to resist the slightest touch of organs like our present ones, or of making on such organs the smallest impression of weight, density, ponderability, palpability and penetration, at all perceptible?

This has in it a something at first sight truly startling.

For even admitting that the numerous productions, not only organic and living, but even lifeless and inorganic which every day still, from beginnings imperceptible to our senses, gradually arise in the atmosphere, at the surface and in the recesses of our globe, and grow and

become more and more perceptible, the materials may at first in part have from higher and more distant regions been driven to our atmosphere —a thing which no person of the least observation can doubt, in as far as, on the one hand, these entities on first combining from above gradually increase, and grow, and acquire palpability and ponderability and weight and substance, in greater proportions than the earth underneath loses these; and, as on the other hand, these entities again in decombining lose more of these conditions than again reverts to the body of the earth underneath; and thus must of these conditions first receive and next return to the regions above a great proportion in the shape of mere imperceptible radiance—still is it plain that of most of the latest and most superficial creations and substances some portion proceeds from and again returns to the earth underneath, and must for ages without number have lain deposited in the bosom of that earth, out of all reach of surrounding radiance.

But millions of centuries are of little moment in the formation and changes of the universe; in the manufacture of the globes that fill its vastness.

We are forced to admit that even those substances, those modifications most hard, heavy, and cohering, which we can bring up from the deepest recesses of the earth accessible to us, are

all, unto the furthest and innermost, able again to decombine, till by decombination they lose whatever rendered them solid substances; and, in thus decombining, all again resolve themselves in mere imponderable, impalpable, unfixed radiance; and therefore—unless we suppose that of the body of this globe the substances at the beginning of time and at the outermost boundaries of space were very different from what they became since—a supposition scarcely admissible, scarcely analogous to the gradual progress of all we perceive—we must also suppose that of these substances every part began by being what we call radiant, and what we often still find to be, to senses like our present ones, wholly imperceptible; we must suppose that all globes which now have solid nuclei, at some earlier period only were composed of mere matter wholly gaseous, like those nebulæ which still appear in distant parts of the heavens, and of which some already appear to contain the kernels of more solid incipient worlds; and at some period still more remote were formed only out of mere aggregates of radiance somewhat more condensed than what pervades the sky in general, by being first by gravitation of a centripetal sort driven to certain of its foci; and were round these foci, by the later offspring of gravitation called electricity of a condensing and combining sort more pointedly denominated cold, so collected and concentrated, as there to

acquire a, to us, more sensible ponderability, palpability, and cohesion.

We must suppose that every particle of solid substance of every globe, however near its centre, however distant from its circumference, however remote from all radiance—from light, from colours, from cold, from heat and others—however quiescent, torpid and unchanging it now may be, first arose out of, and for some time continued to remain exposed to, further radiance; and that only after later supervening radiances had over the prior radiances in which began solid bodies, superstructed new and more external solid strata, these former ones began to be by the stoppage of further influxes of light and heat &c. from without, doomed to that unceasing obscurity, and immutability and torpor, into which the interior of our globe has since lapsed and remained.

In fact, how constantly do we not, to this very day, under our very eye, still on all sides from the most distant surrounding realms of space, where their excessive tenuity and diffusion does not yet allow our senses to discern the radiances which our mind tells us must there already in every sense and direction cross each other, find rays of gravitation, electricity, light, colours, cold and heat, as they approach nearer to our earth, by becoming more condensed, already, even in their still radiant state, also in some de-

gree become more capable of impressing our senses with sensations of ponderability, or palpability, or pressure, or penetration, or visibility; and by degrees assume the shape more compact, more definite and more durable of gas, of vapours, of fluids, of liquids, and of solids—of atmospheric air, of clouds, of hail, of snow, and of ice.

And though from the regions of pure radiance, and from the gaseous atmosphere within it, such substances liquid and solid as mere water and ice, formed out of the combination of elements more simple, are seen in the shape of rain, hail, sleet, snow, and the like, to fall more copiously and constantly than other substances liquid and solid even still only mineral, but formed of elements more multifarious and complex, how often are not iron, silex, salts, chrome, nickel, alumina, lime and other mineral substances themselves, first so diffused as not to have gravity sufficient to overcome the resistance and to divide the density of the more general gases of the atmosphere, by degrees through electricity made in air to agglomerate in substances and solid bodies so dense and weighty as to fall to the earth in the shape of atmospheric stones,—and as then to present, with the weight of lead, the hardness of diamond and the cohesion of hair and wool.

Nay, though, whether this arise from their being formed in space less generally than the

materials of the substances thus far named, or from their being more diverted than in former periods they were from their propulsion to this third or fourth rate globe, we actually, of those substances oily, fatty, gelatinous and others, more necessary to the composition of bodies organic and living vegetable and animal, detect less on its actual road from the sky and the atmosphere downward to the surface of our earth, how often do we not, even of these latter sort of substances still at the surface of the globe discover enough, lying in its crude uncombined state, to infer that the whole of that which now contributes to the composition of its vegetables and animals originally came to it from higher regions in a radiant state.

In the beds of the clearest brooks, when long exposed to the influx of electricity, light, colours, and other radiances from on high, are still made to appear,—assuredly not as having come from underneath,—sediments of a mucous nature sufficient to make the very pebbles become slippery. At the bottom of the clearest vessels, long exposed to similar radiant influxes,—even at the surface of the brightest panes of glass long left unwiped in the face of day,—are seen to accumulate deposits which gradually grow into positive microscopic vegetables and animals. Some vegetables indeed, like the air-plant of China, without ever wanting any further contact

with the solid substances of the earth than is merely necessary to support their weight, from mere air have their solid limbs daily grow and increase, till they at last attain a considerable size; nay, after certain gaseous elements of the atmosphere, first balancing and supporting each other, so as to let through the radiant light and to be left transparent, have by some subsequent disproportion experienced those partial collapsions and accumulations called a blight, which cause them to become opaque and visible to the eye, the air itself becomes for miles suddenly filled with myriads of animalcules, unseen before, and unproduced by parents of the same sort, which must, out of certain of these elements, first radiant and next gaseous, liquid and solid, collapsing and condensing, suddenly and spontaneously have been formed and combined.

It cannot be denied that there is no substance so hard, so dense, so fixed, so solid, so cohering, so difficult to penetrate, to change and to dissolve, which cannot, by the agency of certain forces, be by degrees released from the cohesion, the combination, the solidity of its component parts, and made to return to a full state of liquidity, fluidity, vapour, gas, and ultimately radiance; and consequently, since all things created and perceptible seem to have begun by being in a state more diffused and more simple, before they became more condensed and combined, we

must also believe that they first floated in space in that state of radiance and absence of combination to which they are again able subsequently to return.

Substances must, even in that state of radiance in which gravitation does not yet from one side press on them sufficiently to make them on the other side offer to our senses a perceptible weight, already have a degree of diffusion or condensation greater or smaller. Nay, those substances which afterwards in their shape no longer of radiance, but of greater fixity, offer to our senses effects and impressions different from those offered by other substances, must already intrinsically, even in their earlier radiant state, and before these differences can yet be perceived by us, possess the seeds of them.

And that all those substances which afterwards become more stationary, more palpable, more ponderable, more cohering, more resisting and more pressing, in their radiant state already did possess such differences from each other as afterwards became more distinctly perceptible to such sense as ours, is a circumstance which may from those substances that even in that radiant state, when sufficiently condensed, become occasionally perceptible, be collected: rays of mere light and of different colours,—whether they be composed in part of different condensations of rays of gravitation, effected

through different actions of the force of electricity upon them, as I suppose to be the case, since I see them preceded and surrounded by such rays of electricity, and by nothing else perceptible more early and general to which I can assign this effect; or whether they be composed entirely of some other modifications still unknown to us,—already each in their radiant state generically offering an intrinsic degree of dilatability and contractibility,—a polarity, a pressure, a leaning, and a quantity of cold and of heat, different from others.

Were our senses sufficiently fine to perceive unto the most distant circumference of space, the most incipient beginnings of all the forces and movements, combinations and decombinations, of which the later and nearer results, in the shape of entities, events, substances, and bodies more condensed and stationary, alone are as yet perceptible to our grosser organs of perception, what an extent, number, complexity and diversity of cords, and pullies, beginning in the largest collective masses and ending in the finest distinct filaments—what an apparatus, what a bustle, taking its origin from the very commencement of duration and from outermost outskirts of extension—should we behold, pervading every portion of time and of space at present still to our dim eyes a complete void, and, like concentric ropes, in uninterrupted continuation tending to the most di-

stant future points of that time, and the innermost future recesses of that space; and from time and space past, present, and future, again by recoil made to travel outward in every sense and direction! How at every point in time and space these connecting forces would be seen to cross each other; to precede, to surround, to weave, to form and to increase millions of globes; to arrest, to suspend and to move them, and on each of them again to produce millions of entities and modifications mineral, vegetable, and animal, radiant, gaseous and solid, more minute and more finished! How filled would appear every smallest portion of that time and space, in which we only at present at distant intervals and in small spaces behold floating a few comparatively rare aggregates of perceptible substances and bodies, separately wandering in the tenantless surrounding regions!

Let us hope that some day or other, in a globe more central and more perfect than this, and, from that situation more central, itself endowing us with organs of sense more fine and better situated, this glorious spectacle, at present withheld from our sight, will display itself to our astonished eyes, and in the contemplation of it furnish us with means of never-ending enjoyment and felicity.

I shall now, in as far as I can perceive them, describe the various lesser and later modifications which out of the materials, by certain portions

of the radiant forces of gravitation first supplied, and by certain of the forces of electricity, out of certain of these very forces of gravitation themselves arising next again remodified, gradually proceed; and from the state of mere radiant forces gradually pass over into that of different more solid substances—beginning with the most early and general of these modifications perceptible by us.

CHAPTER XVIII.

Of the modifications by electricity of a combining sort, first, I believe, out of a portion of the rays of gravitation formed, and by degrees from the state of mere radiant forces condensed into that of substances, the sort most early and general and elementary seems to be that called light.

Electricity of a combining sort seems itself, within that gravitation whence it first originated, to have of portions of that very gravitation itself formed the first cradle of more solid substances and bodies, before in this cradle were deposited the materials and were woven the forms even of light, after mere electricity that first immediate element of all bodies more connected, distinct and solid, from the largest of heavenly globes itself, to the smallest that on this earthly mass again subsequently springs forth; since at first of these bodies even light itself seems to impede the formation and growth: since at first they seem to shun the garish eye of day: since their first developement seems only to take place in darkness; though soon the more substantial food of light becomes requisite for their further extension and consolidation.

While and where light existed not yet, time

and space, gravitation and electricity, and whatever else of modifications created might already exist, and even exist perceptibly to certain senses such as ours, could still only exist in total darkness,—this word expressing only the absence of light.

People have frequently thought light to be immediately connected with heat—but it is not so. Light is neither the offspring, the necessary companion, nor the parent of heat. It has with heat no direct nor indispensable connexion. Metals often give out intense heat, while they give out no light whatever. Snow and other phosphorescent substances often give out intense light without any symptoms of heat. On the contrary cold is often accompanied, as in aurora borealis and australis, by sensible light: but, because the electricity of a decombining sort which produces the feel of heat, or the bodies and substances combined by cold, on dissolving, let out with the cold that combined them, the light that was incorporated in them; and occasion this light, before fixed and dormant, again to disengage itself, to move, to distend and to strike the eye, the sensation of heat and that of the light it disengages are often so closely allied, as to have caused the supposition of there being between them a closer connexion—the supposition of light deriving directly from heat itself.

We have already seen that in reality light seems in part from gravitation, from which are derived its materials, and in part from electricity of a combining sort, from which are derived its form and visibility, to take its origin: since mere electricity in aurora borealis and australis, in sheet and other lightning, in natural meteors and in artificial electric experiments produces light, even where solar light cannot penetrate; and where light, already incorporated in solid substances of the earth, is not again emitted: since the very light by the sun itself, our great luminary, and by the other fixed stars and planets emitted, seem the later effects only of the materials of that light, first by these bodies from surrounding space in a shape less perceptible, and not yet lighting up their darkness, imbibed; and which materials thus can only be supposed to have proceeded from combining electricity itself.

Probably after gravitation converging and centripetal had first formed those distinct foci, the cradles and seats of future worlds; and had on its return outward from these seats in a centrifugal direction, with fresh gravitation centripetal, in the vast surrounding regions of space formed the stores of electricity—the first materials of light,—further gravitation of a converging sort hying to these foci, of this electricity and this light thus far diffused in an imperceptible state in the regions of space, from

all sides drove portions to and compressed them round these foci in those denser masses which first lit up these sites of future globes, rendered them visible, and, when from these again emanating outward, caused them to become perceptible to distant beholders, as soon as any such beholders arose to contemplate them.

Of these foci of gravitation and seats of future globes, the earliest and largest first received all the materials of the light which first kindled them up, from surrounding electricity, in a state so diffused as to remain to us invisible: and thus received in a covert and a concealed manner that which, in them more becoming condensed, was again subsequently on all sides issued forth from their precincts in a way more open and undisguised; because this mode of these foci being constantly by surrounding electricity, as constantly from surrounding gravitation and from the first cause of that gravitation, emanating, supplied with light, is the only way to account for their constantly letting out light, without being by that constant emanation wasted or consumed; and yet, without being with the materials necessary for its formation, kept as constantly supplied in a perceptible, open and avowed way.

Thus however these primary globes obtained the credit of shining with a light of their own, not derived from any thing else anterior to itself, and outside itself in time or space:—as if such a

circumstance could, conformably with analogy, within the limits and short of the most external yet unknown cause of time and space, and of whatever other modifications are from this unknown source poured into these limits, be supposed to exist.

The seats and foci of the converging gravitation of a mere secondary sort, subsequently out of the recoil of the more primary gravitation, again diverging outward in part, formed, would likewise from general gravitation and electricity receive and again radiate outward some light; and in fact in the moon we observe a strong phosphorescence: but they would comparatively remain immersed in obscurity, until from more primary globes, with the gravitation radiated outwards, was also radiated outward, and at second hand driven to these secondary foci, more of the light already in these primary foci more condensed and rendered more capable of impressing the sense. These latter foci thus received light from a twofold source, first from general surrounding electricity, and next, from the central body of their system, and while this body has been called a sun, or, most erroneously, a fixed star, the others have been called planets, satellites, comets, &c.

When from those heavenly bodies in which the light, originating in surrounding electricity, first acquires a more permanently visible shape, that light again radiates outward, it again by degrees, as when first it was out of electricity formed, be-

comes so diffused and so rarified as by the rapidity of its motion to elude and baffle all attempts to fix it; to prevent its making on senses, still so obtuse as ours, any impressions, and again to leave surrounding space and objects in utter darkness. Only the distant stars, from which this light first departs in a more condensed state, appear athwart the general surrounding obscurity to twinkle like diamond spangles studded on a dark veil.

When, again approaching and made from different sides to be deflected toward, and to converge and condense round later secondary centres of gravitation, these rays of light again become anew more condensed, they also again become anew more capable of immediately impressing the eye.

When afterwards round these foci of secondary gravitation prior light more condensed, had formed an atmosphere more substantial and more cohering, itself made to follow the movements by gravitation impressed on these foci themselves, this atmosphere would by its resistance and movement, in the fresh rays of light by distant bodies cast upon it, cause a curve: and these rays of light being the only medium through means of which the distant bodies from which it came could make an impression on the eye, this curve would cause the impression of celestial objects not to appear to us in a line straight with that of their real situation in the heavens, but in a line so deviating from that former one as to

make them appear to rise above our horizon before they really did.

Light, in the first and simplest and most diffused state in which it springs forth from mere electricity, and becomes perceptible to our sense, seems still only to possess the conditions of a more radiating force, a little more complex only than that of mere gravitation and mere electricity themselves, whence it proceeds.

It has velocity of motion, straightness of direction, continuity of form. It has elasticity, dilatability and contractility to a prodigious degree. It offers, according to the direction in which it is propelled, convergence towards or divergence from other rays. It is liable to be by other portions of the same or of other forces and substances, themselves still only radiant or already more solid, when meeting it in a straight line, resisted, arrested and made to accumulate; and when meeting it at an angle, liable to be divided, deflected, let through obliquely, refracted, or reflected and made to retrograde. When alternately made to cross or to be crossed by the rays of another force or substance, it displays pulses or alternate periods of advancement and of arrestation; and finally it may by other forces and substances be so arrested, accumulated, compressed and condensed, as from being very rapid in its motions and very rarified in its quantity, to become very dense, fixed and stationary; from being in small quantities diffused over a wide

extent, to become in large quantities compressed in a small space; from yielding to the smallest pressure, to become capable of resisting a pressure very great; as by degrees from radiant to become gaseous, liquid and solid; and from only, while in its radiant state able to strike the finer organs of sight, in its later state of greater compression, condensation, arrestation, combination and incorporation in different species of gases, liquids and solids, by its greater resistance, pressure, weight, ponderability, and palpability, also to be able to impress with its dimensions, form and movements, the coarser sense of feel more distinctly.

After gravitation and electricity of a combining sort, the prior parents of light, light itself appears in its turn, either still imperceptibly or already perceptibly, one of the chief component elements of most other substances radiant, gaseous, liquid and solid, mineral, vegetable, and animal, merely vital, sensitive, or moreover intellectual, in as far as most of these substances, again later and more partial than mere light, in their earliest and most general state even only of mere radiance imperceptible or already perceptible, such as that of different mere colours;—and thenceforward in whatever other shape and under whatever other denomination again more late and partial of gases, such as of oxygen, hydrogen, nitrogen, carbon and others; or of minerals, such as sulphur, metals, alkalis, acids, earths

and others, or of a vegetable description, such as albumen, gelatine, or others, or of an animal sort, such as lymph or chyle or blood, or bile, or nervous fluid, or others—they again appear, already seem in part composed of the earlier elements of light, and of later particles of light itself; and when, whether by gradual exhalation and evaporation, or by more sudden and entire detonation or explosion, or by effervescence, or slow combustion, or putrefaction, or otherwise, from a more solid state they are again decombined and made to return to a state of radiance, again emit, next to mere gravitation and electricity of a combining sort, portions of light first combined in their substance in a way less or more perceptible:—certain bodies like the moon, the aurora borealis and australis, sheet and other lightning, certain clouds, vapours, water, minerals, vegetables and animals,—snow, sulphate of barytes, bologna stone, oyster shells, fire flies, glow worms, and other entities, called phosphorescent, already again visibly letting out part of the light combined in them, even previous to and without general decombination; and inasmuch as when in their formation and composition and growth substances have not of light received a sufficient quantity, they attain not that perfection to which their genus seems to entitle them, and remain in their texture more loose, lax, feeble, inelastic, pale and deficient in form and faculties than they ought by their nature to be.

The places and modifications in which directly from electricity arises light, such as those occupied by fixed stars, by suns and by lightning, are called self-luminous. Those whence, after light has in them in a mode still imperceptible or already perceptible to us, penetrated, it again spontaneously and without effort or general decombination, in part visibly again issues, are called phosphorescent. The bodies which after having let light in at one side, suffer it to pass entirely through, so as again to be let out at the other, are called transparent; and when their solid component parts, and the intervening interstices, are so disposed as to cause the rays of light in their way athwart them to be from their straightforward direction deflected, and only to go out at an angle from their prior entrance, they are called refracting. Bodies in which the light from one side falling on them remains engulphed and buried, so as not to pass through them, and again to issue at the side opposite to that at which it entered, are called opaque. While bodies of a transparent sort give through the medium of light no impression of themselves, because the light from more distant quarters reaching them, passes entirely through, bodies that entirely absorb, engulph, and render quiescent in them the light they receive, also send not of their existence through any intervening medium an impression to the eye. They leave surrounding space in darkness, but this darkness caused, not by their

receiving no light, but by their concealing the light which they receive, is called blackness.

Other objects cause the light falling upon them to be from their surface again reflected backwards, and they then give the eye on which that light falls, through its medium, an impression of their existence.

The rays of light reflected by an object in consequence of the lesser or greater distance to which they travel before they reach the eye, cause, by their less or greater concentration, the impression of that object before it reaches that eye to occupy in the same a smaller space compared with that of the object itself by which the rays are reflected: nay if these rays, in their journey from the object from which they are reflected, are again deflected before they reach the eye, they will in that eye present the image of that object in a place different from that which in reality it occupies.

From the way in which substances are solidified, most of them, in solidifying, become so porous, and acquire between their solid parts intervening interstices so numerous and wide, that while only forming thin plates, they let through all the later light that falls upon them, and by not stopping any part thereof on either side, themselves still remain invisible to the eye; even where they already with their powers of resistance and pressure affect the sense of feel. Some of these substances, like crystal and glass,

from the regularity of their pores, even remain transparent in large masses, except when by friction or otherwise the regularity of their pores and interstices is so disturbed as to stop the transit of the light; when they become opaque.

Other substances which in thin plates are transparent, in thicker bodies spontaneously arrest the light and become opaque: and though of gases, less closely knit together than cohering solids, a greater number still remain transparent, even of gases a few, whose interstices fit not regularly on to each other, already become less or more opaque.

Substances which, like most stuffs and like paper, from the irregular form of their wider interstices, already of the light admitted in them bewilder and arrest so great a quantity, and let so little pass through them, as to become in part opaque, often, where their density is increased, but by such a new substance as, like wax, water or oil, through its more uniform interstices to make the light pass more regularly, have through that more regular transmission of the light, a greater transparency again given them.

It is by certain substances having interstices and parietes so disposed that, instead of receiving and transmitting the light equally in all directions, they in some directions transmit, and cast the light forth falling upon them more powerfully than they do in others, that they shew what

is called polarization of light; but it is evident that this circumstance depends not so much and so primarily on the primitive nature of the light itself, in its radiant state, as on the form of the molecules of the peculiar substance, already solidified, on which this light happens to fall.

Where from objects self-luminous, or reflecting light, that light falls on other objects opaque, so dense and smooth that, like mercury, they retain and absorb none of its rays, but, again, at second hand reflect the whole of them to the eye so completely as to give that eye circuitously an impression of the visible form and movements of the object whence it first departed, that light, thus at second hand and circuitously propelled to the eye, depicts on the organ the image of the first object whence it departed alone; and the intervening substances or media which reflect it, themselves imperceptible, are only called specula or mirrors.

Objects which, while externally offering a surface rough and uneven, of the rays of light falling upon them bewilder a great many, cause the few they reflect to the eye to make little impression on that organ, and to appear faint and vague. When of these objects the surface is, by polishing away a part, or by filling in the interstices between the molecules with varnish, rendered more even and smooth, it renders, by reflecting the rays of light more

evenly and closely, the impression on the eye more vivid and distinct; as cabinet-makers and picture-cleaners know: but sometimes these latter persons overshoot the mark. They give their pictures so high a polish, that none of the rays of light falling upon the surface of these objects take any hold on or penetrate them at all; that all are so immediately reflected as to transmit no impressions of their internal modifications, and only to render them specular and capable of transmitting circuitously and at second hand the images, first from some more distant objects falling on themselves.

Mere light, divested of the admixture of colours, only makes on the eye an impression of whiteness. The light emanated or reflected from the moon is white; that emanated from the sun, coming from that body mixed with rays of various colours, no longer is a pure white.

Different stars and planets, probably from the different way in which electricity combines in or acts upon them, emit their light mixed with different colours.

The light coming directly from electricity, or from the first laboratories to which electricity naturally imparts that light, and from which it is again naturally and spontaneously let out, is called natural light: all such light as is by man from substances intentionally through decombination again extracted is called artificial light. Such is that given by a lamp and candle when ignited.

If the light coming directly from the sun is supposed to have powers which the light drawn by combustion from earthly objects has not: if the former seems to give flowers a hue, an odour, —fruits a maturity and savour,—vegetables and animals a brilliancy, and human faces a vividness of complexion and a vivacity of expression which the latter sort of light imparts not to these, this probably arises less from any difference in the nature of the light itself, than from the light which comes straight from the sun, coming accompanied by a great many other species of elements and substances, in their radiant state not yet distinctly perceptible, which are by different earthly bodies again separated from that light, and absorbed; and of which the light embodied in a coal fire, a lamp fed with train oil, or a tallow candle, is consequently already divested, before it enters these bodies and substances.

Of light a certain quantity seems directly to be from electricity supplied not only to suns and stars of the first order, but, though less copiously, in some degree also to planets and satellites. These latter, however, receiving less light all round directly from electricity, are more dependant on what they receive at second hand ready formed from their sun: but when these bodies become opaque, the latter species of light can only fall on one side of them at a time, and can only fall successively on opposite sides as these are successively turned towards that sun.

While from some bodies a slight pressure suffices to cause the light absorbed by them again in part to issue, from other bodies, the strongest and most accumulated decombining force alone can again drive out that light, and reduce them to a state of combustion.

Light, when from the shape of radiance it is sufficiently arrested and condensed in the shape of gas to become endowed with a peculiar more distinct and more permanent form, is called flame; but when from a state of mere radiance light is first condensed, it does seldom remain long enough in the closer transient state of mere gas, to become in that state perceptible in the shape of flame, before it assumes a shape still more cohering, liquid or solid. It is only when, after having been condensed in other bodies gaseous, liquid or solid more complex, it is again by decombination of such bodies let out in little time and space in great quantities, that, nearer to these bodies it preserves its gaseous state of flame in greater quantities long enough to be distinctly visible, before at a greater distance from these bodies it again is more entirely unravelled and made to return to a state of mere radiance, in which it again diffuses itself through space more rapidly and imperceptibly, and only again shows the more distant objects from which it is reflected.

CHAPTER XIX.

Colours.

Because from the sun, the chief source of the light received by this earth, that light comes mixed with the rays of different colours, and because from the rays of light and from those of each colour singly we may again separate those of each other different colour, rays of light are supposed to be singly composed of the union of the rays of all the different colours, combined together in a fasciculus; and to be singly later and more complex than the rays of any peculiar colour taken separately.

This I find some difficulty in believing; since from different objects light can be so emanated as to impress the eye with a mere sensation of whiteness, unmixed with that of any peculiar colour, whereas no peculiar colour can impress the eye without a certain degree of light; and since all objects that, from first letting the light through so as to remain transparent, by degrees become opaque, first acquire mere whiteness before they acquire any particular colour; since, while the light of the sun, ac-

companied by other radiances, is coloured, that of the moon, divested of those other radiances which accompany that of the sun, is white; since, after heat has again caused substances to decombine to a certain degree, so as to make them lose the colours they displayed, they still show a residue of white light before they disappear in total radiance; and since, when the different colours are intermixed so closely in such equal quantities, that the impression of each separately disappears and merges in a joint impression of all united together, that impression does not become that of white, but of gray.

I therefore believe that though electricity produces not only white light, but the different colours, it is through the medium of prior white light only that electricity more lately and partially produces the different colours; and that only through the different new peculiarities of form and movement electricity gives to white light, it endows this light before white with each peculiar colour: since the rays of each colour singly have a movement, a direction, a dilatability and a contractility, different from those displayed by those of each of the other colours.

Of the primitive colours, none entirely different from mere light, because they must each in part be founded on and composed of the materials of mere light, but each singly entirely independent of the other different primitive

colours, there are three, namely, blue, red and yellow. Of each of these colours certain portions may again, with portions of either or of both the others, be so minutely intermixed, that the impression of each shall no longer be separately discernible, and that they shall together produce a joint impression intermediate between the former. The impression of red and yellow mixed being called orange, that of red and blue mixed being called purple, and that of blue and yellow mixed being called green; while that of all the three mixed, according as that of one or the other prevails in lesser or greater proportions to the remainder, is called gray or brown.

With the pure light that only produces whiteness, each colour may be mixed in different degrees, so as to produce deviations from pure whiteness and shades of peculiar colours offering different degrees of depth; until at last each peculiar colour may become mixed with pure light in quantities so great as quite to overload that light; and as to prevent its any longer remaining able to serve to that colour as a vehicle, capable of carrying it to the eye, but on the contrary to leave that colour where it alights entirely to drop and be absorbed; so that the eye shall only with regard to the peculiar spot where the colour is engulphed remain in that state of absence of impression called, when more general, obscurity—when more partial, blackness.

Like mere light, the various colours, originating in electricity, but only originating in re-modifications of that electricity somewhat more complex and partial than mere light, are first from electricity by converging gravitation carried to and made to accumulate in its first and most central foci; and there further condensed and elaborated.

And from general surrounding electricity not only light, but various colours, may also already in a certain degree be directly supplied to other foci of gravitation more late and partial.

Still will the earlier and more central foci of gravitation, which in part supplied the secondary gravitation of the later and lesser foci, to these later and lesser worlds also at second-hand dispense, as well as mere light, the various colours ready made in greater plenty; and according as these secondary worlds again, of the colours elaborated in themselves or reflected from their suns, retain or again reflect certain sorts in greater quantities, they will shine with different hues. Saturn shines red, Jupiter green, the moon white.

Like electricity and mere light, the various colours are in their primitive state still entirely radiant, contractible and dilatable; liable to divergence and convergence, to transmission, refraction and reflexion,—to being, from different points, by alternate intervals of arresta-

tion and advancement, or pulsations, made to cross each other,—to being arrested and accumulated and condensed, and from their state of radiance, in which to us they still are imponderable and impalpable, by condensation converted into gases, liquids and solids more dense, more ponderable, and more cohering,—and again, to being from a state more solid and condensed decombined into a more diffused and radiant state: but in all these different states they each still seem to show from each of the others, and from mere white light, the fundamental differences which already from the first distinguished them from that mere white light.

Like mere white light, they are, when gaseous, collected in the form of a flame, preserving the hue of the peculiar radiance of which it is composed.

Different objects, of the different colours which form their surface are reflected, transmit the impression to the eye. Of those colours of which they absorb the whole, and reflect no portion whatever, the eye becomes not aware. When objects are lighted up from behind, the light passing through them conveys along with it the colour with which it is loaded; nay, it even again detaches and conveys along with it part of the colours by the substance before taken in, which in them were become quiescent. Gold, which, when only seen by reflected light appears

yellow, when viewed by a light passing through it, appears green.

Solid objects cohering in very thin plates let the different colours through their pores so as not to reflect any. Those objects which are in masses sufficiently thick no longer to let colours entirely through, but of the colours hovering in air to reflect some, and from the shape of their component molecules to reflect certain colours at an angle different from that at which they reflect other colours, where seen in different aspects, will show different colours; as do the scales of certain fishes, and the feathers of certain birds. Substances still denser, and absorbing certain colours entirely, will only show those colours which they do not absorb, but reflect.

Of the rays of different colours proceeding from the sun, the more yielding rays of blue, being alone in the day-time reflected from the sky, while the more sturdy rays of red and yellow pass on unresisted, in the day-time make that sky look blue. The rays of red and yellow proceeding from the sun, having at nightfall to perform athwart the denser vapours of the atmosphere a longer journey, are there at that time also reflected in so much greater quantities than before, as then to make the clouds appear fringed with purple and gold.

Objects so smooth as already to reflect the mere light falling upon them sufficiently to be-

come specular, will in the same way reflect the various colours cast upon them.

Different substances, according to the different forms of their component molecules and interstices, and according to the different way in which the rays of different colours fall upon them, will of these colours transmit, retain, or reflect different sorts: and chemical combinations, which change the internal form and composition of substances, will also produce changes in the colours they transmit, absorb, or reflect. Blue appears the least tenacious of colours, and to be made to quit substances soonest. Red seems to enter later, and to leave them less readily.

In certain substances and bodies, mineral, vegetable and animal, not only a certain portion of light but of colours is poured so loosely, that of those which during the day-time the pressure from the sun caused to flow in, at night, when that pressure ceases, a part is again suffered to escape; as we see in the glow-worm and the fire-fly.

In other substances and entities, not only light but colours are imbodied so much more forcibly, that they can only again by the strongest heat and most general decombination be expelled.

From some bodies, in which radiance of colour from the sun produces various hues, radiance of heat and others from that sun again drive out these hues, and cause the objects again to fade.

Certain bodies, first sufficiently porous to let light and colours through and to remain transparent, when their surfaces are, through corrosion or otherwise become so rough as to have the interstices between their solid molecules disturbed and rendered irregular, will retain, absorb, and reflect not only light but colour in such a way as to appear opaque, and not only white but opalescent.

Some substances, in which colours different in tenacity have successively been combined, will also through different degrees of decombination let out these different colours successively. Thus foliage, first, while formed in obscurity, still white, by degrees, as it developes further, appears yellow and green; and as it again decays, again turns yellow and brown; and other bodies, while decomposing more rapidly by combustion, as their colours are successively discharged, first let out a blue, next a red or yellow, next, in their last stage of decombination, a white flame.

Not only light but peculiar colours seem, by condensing in bodies mineral, vegetable and animal, to contribute so powerfully to their completion, that those bodies of each sort not sufficiently exposed to the radiance of the sun—that great source of light and colour to the surrounding planets—remain in their external hues faint and indistinct, and in their internal texture lax and

feeble; in their forms unfinished, and in their faculties short of the tone and vigour which the perfection of the genus seems to require. This we see in plants, which, reared in obscurity, remain etiolated; in animals, which, kept in darkness, want strength and spirits; and in human beings, which, left to pine in dungeons, in cloisters, and in harems, become feeble in body and depressed in spirits.

The light and colours, formed in the sun, and again emanating from its surface, seem first over its more solid nuclei to form a gaseous atmosphere or canopy of flame, which, where it is more rarefied, leaves the appearance of dark spots, or gaps seen through at a certain height from its body. This envelope, still visible, further unravels, entirely loses its cohesion, its perceptibility, and, becoming radiant, again plunges into the unfathomable realms of surrounding space; in which on all sides it advances unimpeded, till, again approaching the converging gravitation of other surrounding worlds, it again is by that gravitation drawn in and made to contribute, first in its state of radiance, and next in that of gases, of fluids and of solids, to the atmospheres and kernels of those secondary bodies.

The circumstance which of light, and of the colours mixed with it, when they first originate in electricity, or when, after having been condensed in solid bodies, they again from these

bodies are liberated and left to return to radiance, proves the tenuity, is that from a candle with its light filling a whole room, when, by that candle being extinguished, that light seems on one side to cease being supplied from its source, and on the other side seems to have its further diffusion and propagation arrested by the walls of that room, on those walls, of that light which has long travelled from the one to the other, nothing visible or tangible, palpable or ponderable, is left to collapse, to accumulate and to remain; except it be by slow degrees that dust so fine as hardly to be perceptible, which yet on every stationary object to which light has long penetrated, and by which light has been long arrested, seems at last in certain quantities to collect.

CHAPTER XX.

Savours—Odours.

We have seen how out of modifications of time and space, and out of forces of gravitation and of electricity of a combining sort, arose most of the modifications that cause impressions of feel and of sight:—those of duration, extension, pressure, resistance, weight, buoyancy, cold, substance, light, colours, forms and movements tangible and visible, radiant, gaseous, liquid and solid.

We have still to see how out of these modifications arose those that cause impressions of taste, smell, and hearing.

I have already observed that like light and colours, savours and odours,—though arising more remotely out of time, space and gravitation, which are the earlier materials of electricity itself,—more proximately arise out of that electricity, inasmuch as the mere force of electricity, when strongly condensed, already, without the intervention of solar influence, immediately produces peculiar flavours and odours; nay, since certain flavours and odours are accompanied by a peculiar sensation of coolness or heat, pun-

gency or penetration, which we already know only to proceed from electricity.

Like the modifications of light and colour, those of savour and odour first probably arose out of the force of radiant electricity, in a state of such diffusion as still to be imperceptible to senses such as ours. These modifications of savour and odour likewise appear first from surrounding electricity to have been poured in the greatest quantity in those foci of gravitation of the first order, in which gradually arose and kindled up suns and fixed stars.

Partly from this same general surrounding electricity in a manner more direct, and partly from these primary globes in a more circuitous and second-hand way,—but in a shape already more condensed and elaborated, and in company with rays of gravitation, of electricity, of light, and of colour,—rays of savour and of odour were transmitted to the more secondary globes, called planets, satellites, &c. Since on our earth certain substances and bodies seem to acquire these attributes of savour and odour even without exposure to solar radiance, though many of them seem to attain these in a greater measure only by being longer exposed to the influence of the sun.

Like light and colours, later savours and odours, first radiant, seem by degrees to be by certain substances arrested, accumulated, fixed and rendered gaseous, liquid and solid. By the pressure of electricity they seem with peculiar

substances formed by light and colour, whether still only gaseous, or whether liquid or solid,—in consequence of the shapes of their solid molecules taking a proper hold of those of these savours or odours,—to become incorporated; and by decombination they seem again from these bodies to be liberated, and, when in sufficient quantities conveyed to the sense, able to produce in the organs of sensation the peculiar impressions we receive of savours and odours.

Savours and odours, affecting organs of sense different from each other, must not only be different intrinsically, but originate in modifications of electricity as differently disposed. It is however true that in their origin these modifications, though already different from each other, must still be nearly related, since the senses of taste and of smell always arise close to each other, and in such relative situations as only to render the sense of smell apparently a further development of that of taste; since the same external causes that sharpen or blunt the faculties of the one also sharpen or blunt those of the other; and since very often there even is a strong resemblance between the different impressions which the same external objects make on these different senses.

Like light and colours, different flavours and odours, often in their radiant state imperceptibly poured into bodies, there accumulate, condense and become fixed so imperceptibly, that it is not

till they are again from them made to emanate more rapidly in greater quantities, that they first perceptibly affect the sense.

Flavours more dense, after having been incorporated in bodies, can in general only by liquids be from these detached, set afloat and conveyed elsewhere: odours can often by mere air be extracted and carried to the organs of sense: they can often by mere heat again be rendered volatile.

The odours first from the sun sent forth in a radiant state to the earth, next on that earth again condensed and in more solid objects imbodied, and more lately from these bodies by heat again detached and made to issue forth, when they meet a clear atmosphere and immediately again become volatilised, and return to a state of radiance, diffuse themselves in that state more quickly, and give the sense less leisure to collect and to be impressed by them. When encountering after their liberation a denser atmosphere, they are more arrested in their flight, tarry longer on the road, and give the sense an opportunity of inhaling them longer, and in a less volatilised form. A bed of flowers, often nearly scentless in the day-time, under the influence of a hot sun often at nightfall strongly perfumes the air.

Among the different flavours and odours by electricity directly on this globe produced, or more circuitously through the medium of the sun in a radiant state transmitted to this globe, those

alkalescent, acid, salt and sulphureous seem among the first produced, condensed, fixed and rendered perceptible. The finer and more volatile sorts seem only by objects later and more complex first arrested and fixed; and, like many colours, many flavours and odours seem singly composed of the union and mixture of many others more simple.

It seems almost needless to observe that no substances in nature can in any of their successive states of combination, from radiant to gaseous, liquid and solid, be intrinsically poisonous; that is to say, such as by decombination to destroy or impair bodies by former combinations of similar or other different substances formed. It is only after certain substances have in certain quantities and proportions been combined in certain bodies posesssing certain faculties, that substances of the same or of other sorts, in such quantities or proportions as are calculated again to impair or destroy those combinations, may thereby, relative to these peculiar bodies, become detrimental or poisonous. But the same substances which at certain times and in certain proportions relative to certain bodies, in which they are calculated to increase and to invigorate these bodies, may be salutary, at other times and in other proportions relative to these same bodies, in which they are calculated to decombine and destroy them, may become deleterious and poisonous.

The last species of modifications giving peculiar sensations, again different from those thus far described, which yet remain unnoticed, seem to be those that give to the sense called of hearing the impressions of sound: but as these proceed from mere electricity, or from substances still remaining in their first radiant state, less directly than the former ones—as they only from substances when later condensed in a state of gas or solid materials, and next again put in motion, in consequence of the resistance and shock these molecules offer to each other, seem first immediately to proceed:—as consequently they pervade space even in an imperceptible form less generally than the former modifications described; and as they took their origin at a later period and from a smaller distance, I shall defer the description of them till I have given that of the changes of substance from a mere radiant to a more solid state, in which they first more immediately produce sounds.

CHAPTER XXI.

Substances first by combining electricity out of gravitation formed in a radiant shape, are next by that electricity moulded in a gaseous form.

We have seen that substances of different sorts were by combining electricity, itself first out of gravitation formed, again within that gravitation produced, in a shape thus far still only continuous, volatile, yielding, and generally imperceptible or at least imponderable to senses so obtuse as our present ones, which is called merely radiant.

But there exist substances in another different state more dense, more fixed, more capable of offering sensible pressure and resistance, more ponderable and palpable, called gaseous.

That of these latter substances the aggregates no longer, like those of the former, are continuous, but are divided in molecules very small, separate and distinct from each other, appears, since these aggregates are more elastic—more by pressure upon them contracted, and by removal of that pressure again dilated; a circumstance which can only arise from there being between

their component parts vacua filled by forces which, as they are more or less by pressure dilated or contracted, leave the intervening molecules more to extend, or cause them more to be condensed; and also appears from other later symptoms, which cannot be accounted for unless we suppose the masses of gas to be divided in very minute distinct molecules.

That notwithstanding this greater separation from each other than is offered by any portions of mere radiance, which is offered by molecules of gas, these latter are more powerfully connected together than are the component parts of mere radiance, appears, since molecules of gas offer a greater collective resistance to pressure from without, and a greater collective pressure outward; as we see in wind, which, though only composed of an accumulation of mere invisible gases, by its pressure already may fell trees and lay prostrate men; and moreover see in the general atmosphere, in which gases heavier than others, instead of falling through the lighter ones, are nevertheless often kept supported by or intermixed with these lighter gases; a thing which we can only explain by the molecules of each sort of gas, though divided and distinct from each other, being connected together by some intermediate network of intervening radiant forces, which permits other heavier ones to pene-

trate between, but prevents them from falling through, these former ones.

That these substances thus gaseous derive their intrinsic materials from earlier substances still radiant appears, since, though later, more internal and more partial than these radiant ones, they still in their nature resemble them; only are combined in forms more complex, and when decombined again resolve themselves in the same—in mere radiant light, colours, savours, odours, &c.

That they derive their new gaseous form, their division in separate molecules, and the greater connexion of these molecules together, as well as the greater condensation, fixity, resistance to pressure and weight from without which they show, from forces of combining electricity penetrating from without in them, dividing their before continuous mass in separate molecules, and pressing upon, and confining, and steadying and connecting these molecules together, is a circumstance which we infer from their immediately preceding and surrounding them.

That, as must *à priori* be expected, those radiating forces of combining electricity, in penetrating between masses of substances which, though all alike thus far still radiant, continuous and rapidly advancing, still already each had powers of resistance to pressure in directions

different from those of others, actually divided and moulded the masses of each sort of substance in molecules always in the same substance offering the same shapes, and in different substances offering shapes as different, appears, since of some substances different from each other the molecules cannot at all be made to cohere; of other substances the molecules can only in certain relative proportions be made immediately to cohere; and of others again they can only be made through the medium of a third intervening sort, also in certain definite proportions relative to the former interposed between them, be made more mediately to cohere: circumstances which indicate that their cohesion depends on their being through the peculiarities of their different forms, in certain senses so approximated, and in certain others kept so far asunder, that the pressure of electricity intervening from the latter side so preponderates over the counter pressure of electricity that finds room to act from the former side, as to keep them in the former direction close pressed and cohering relative to each other: a thing which combining electricity and cold must have the faculty of effecting, since decombining electricity and heat have the power of again destroying that cohesion;—and since from the masses of peculiar substances, whether still in the state of mere gas, as well as when in a

state of more cohering and more fixed solids, each other different peculiar sort of substance itself still in a state of radiance, is radiated, or refracted, or reflected in a peculiar direction and at a peculiar angle, always similar in the same and different in different substances, which shows that of each substance in a state of gas, as well as of later cohesion, the mass is composed of molecules and interstices always in their shapes and outlines uniform ;—and since when of peculiar substances the mass before gaseous becomes cohering in solid bodies, so thin that like a chord they can by force and pressure be twisted in peculiar directions, they will, when the constraint and pressure upon them are removed, again of their own accord untwist themselves; which shows that in thus twisting them a violence has been done to the natural form of their component molecules ;—and since when masses, formed by the union of molecules of peculiar substances, are increased by accessions of new masses formed of similar molecules, those accessions always are in a form similar to that of the former nuclei, and different from these exhibited by accessions to other nuclei formed of the union of other different substances ;—and since when these larger masses again are by spontaneous fracture reduced to a number of smaller ones, all these smaller ones separately retain the shape of the larger one; and similar

in the same, and different in different substances; and since even when these fractures are reduced to an impalpable powder, but of which the component substances still retain their cohesion and remain dry, these fragments again by frequent and short vibrations become disposed in peculiar symmetric lines and dispositions; the same in the same, and different in different substances; —all circumstances which indicate these masses having been originally composed of molecules whose arrangement and combination together were owing to the peculiarities of their individual relative forms.

Most substances in their gaseous state still have their molecules sufficiently wide asunder to let radiance of light and others through, instead of reflecting these, and thus, to remain transparent, insapid, and odourless. Some, when their molecules are in their relative situation disturbed, or with other gases so intermixed that the interstices of each fit ill on to those of the other, from transparent and reflecting neither light, colour, savour nor scent, become opaque and endowed with scent and savour.

It is by radiations of electricity which divide substances, before still continuous, in radiant molecules naturally moving in a direction transverse and horizontal to that of gravitation, that of gaseous aggregates the masses seem generally divided in lesser horizontal strata, such as we

already observe in the gaseous atmosphere that first formed and still surrounds our earth, and such as in the electricity which from higher regions pierces athwart them in the shape of thunderbolts, by their resistance to it alternately in opposite directions, causes the zigzag route in which those thunderbolts advance; and as, when these strata of gas are afterwards again condensed in masses of a more solid sort, mineral, vegetable and animal, still produces that shape of follicles heaped one upon the other which, from snow-spangles upwards, all naturally thick bodies are fond of affecting.

The radiant substances first and most copiously by electricity formed, such as those called light, colour, &c. would first and most copiously by that electricity be partly divided, compressed, combined and moulded into the shape of gaseous aggregates, and of these gases a portion would first again by converging gravitation be driven to and collected round its various foci, and there lay the foundation of bodies no longer composed of matter merely radiant. At least all the gases most early and copious in the atmosphere of our globe perceptible, when by detonation decombined into radiance, by resolving themselves in great measure in radiant light and colours, show that they were in great measure part composed of radiant light and colours.

Of the various gases of this description, first in

great measure out of radiant light again variously modified, by electricity round the focus of this globe composed, and of which the innermost part is by later and greater condensation from without by degrees again transformed in vapours, liquids and solids, the sorts most simple, most elementary and most copious are, firstly, that called hydrogen, which, when its decombination is not by other intervening gases retarded, is highly inflammable, and in decomposing lets out much light; secondly, that called carbon, partly at a later period imbodied in sea-coal, in diamond, and in the more combustible part of other minerals, vegetables and animals; thirdly, that called nitrogen, again different from the two former gases in the proportion and combination of its component parts, and contributing in less quantities than carbon to the composition of mere vegetables, and more to that of animals; and fourthly, that gas called oxygen, so formed that by its transit through bodies already gaseous, liquid or solid, it favours the dilatation of their component molecules, the penetration into them of decombining electricity and heat from without, and thus, if this penetration and passage of oxygen is left to go too far, and to become too copious, the entire separation of the particles of these bodies by it, according as they were previously less or more firmly knit together, in the way of detonation, explosion, effervescence,

oxidation, combustion or putrescence; or even by such an expulsion of some of these gases as is followed by the closer condensation and calcination of the others that remain connected.

These four gases every where round this globe intermixed in the same relative proportions, every where round it form alike the bulk of its atmospheric air; so that travelling from one country to another for change of air can only answer in as far as you find more or less of other secondary gases mixed with these primitive ones; and as by a more rapid motion air is in the body renovated more rapidly: but to these primary gases have successively in different parts of the globe been more partially added others more or less complex, which, from their number and their partiality it is more difficult to describe.

What quantity of gravitation or weight these gases can already arrest and accumulate is proved by the pressure they exert on the two hemispheres of a hollow globe, from the inside of which the gases, whose counter pressure outward balanced the pressure inward of the former, have been extracted; and which hemispheres, though loosely applied to each other, can in that state only be drawn asunder by the strength of a team of horses.

Of the gases thus from radiances formed, some already have their molecules separated from each

other, and made to enter the pores of the skin separately, with so much ease, as already to produce in some degree that feel of unctuosity and greasiness, sometimes observable in the very air, but becoming in certain other substances liquid and solid more palpable.

When from among the molecules of certain gases, single or mixed, is expelled or drawn out the combining electricity that kept them apart and fixed, they collapse into liquids, denser and heavier, but of which the parts are less fixed than those of gas in their situation with regard to each other. When this collapsion takes place in a mixture of oxygen and hydrogen, it produces the liquid called water, which again becomes mixed with many other gases more partial.

Of gaseous molecules a part often collapses in liquids between another part still remaining gaseous. In this state they are said to become vapours; and in this state, while by centripetal gravitation made more to converge toward the earth, they are again by centrifugal gravitation held supported at a certain distance over that earth, till by fresh incoming electricity again wholly resolved in gas or radiance, or by mere gravitation entirely condensed in liquids, they either again ascend higher, or descend lower.

CHAPTER XXII.

Liquidity.

Besides substances in a state of gas, we see substances in a state of liquidity, in which they present on the one hand a density, a pressure toward the earth, a weight on the side next that earth greater, and on the other hand a fixity, a pressure toward each other, a cohesion of particles less than they present in a state of gas.

I believe that these substances, thus liquid, arise most proximately from substances in a state of vapour, more remotely from substances in a state of gas, and thus more remotely still from substances wholly radiant: because they only arise after and withinside those substances vaporous, gaseous and radiant; still have intrinsically the same nature with these; only differ from them in their internal form; and again more or less gradually decombine in each of these.

I believe they only in their form differ from substances merely vaporous in having attained in their whole that change, that transition from pure gas to entire liquidity, which vapour has only attained in part, and so as still to have their liquid particles run together, surrounded, sup-

ported, buoyed up, and prevented from being by their increasing weight pressed down to the earth; or rather, in spite of that weight and tendency to earth, by the centrifugal force from earth still kept uplifted in air.

I believe that liquids in their form only differ from gases in this, that while of gas the distinct molecules are still by the intervening force of that electricity, which from continuous radiance converted them into such distinct molecules, kept in their peculiar situations relative to each other, supported and fixed at a certain distance from each other, of liquidity the particles, first by electricity separated and condensed, are, by the subsequent withdrawing of that electricity from among them, again from their fixed situations and cohesion with regard to each other released, and left more at liberty to follow the mere impulse and pressure of gravitation.

This latter circumstance I believe in gases and vapours to produce liquidity, because in that state of liquidity masses or aggregates of substance no longer have that elasticity which they had in a state of gas, and which in that state of gas only arises from the interstices between their component particles being still only filled by intervening radiance more easily extended or contracted; but on the contrary collectively offering a greater density, resistance to gravitation from on high, accumulation of that gravitation over them, and consequent pressure by it down-

ward and weight underneath : and with greater pressure to the earth, offering less of that cohesion with each other which can only arise from their being each in a state of gas more, by intervening links, fixed in their relative situations, than are aggregates merely gaseous.

I believe this radiating force of electricity, which, by penetrating between the masses of substance themselves before radiating and continuous, caused these to become divided in separate molecules more dense, fixed and cohering, was afterwards again, in the more dense state of these molecules, driven away from between them, so as to allow them in that condensed state to collapse ; by being prevented from passing athwart them in opposite directions, so as to enable that coming from each side to arrest and keep in balance that coming from the opposite side ; since air first by the transit of radiance from opposite sides kept in balance, suspended and transparent, where its further progress is by high mountains, and sometimes by mere high towers, on one side stopped, on approaching from the other side these lofty solid apices, becomes vaporous and cloudy so much more frequently and constantly than elsewhere, as to give rise to the belief that these eminences attract from elsewhere the clouds which they first form and collect.

The masses of substance, half collapsed and condensed in a state of vapour, are either in a state of transition from gaseousness to liquidity,

and thus descending, or in a state of transition from liquidity to gaseousness, and thus ascending.

A mass of substance very small in a state wholly liquid and incohering, which is insulated from all larger solid, is, in that state, from all surrounding space by gravitation of a converging sort so equally compressed and moulded, as to assume the form of a round drop.

When an aggregate of substance is, in a state of liquidity, supported by a solid body which on all sides extends beyond it, the gravitation only pressing upon the liquid plash more partially only moulds it in a curve or fraction of a drop more partial; but when the liquid mass spreads very wide, of its surface any small part, though in reality a curve, from the slightness of that curve, is not perceptible as such, and to the eye assumes the appearance of a straight line. Thus water does *not* in reality every where find its level.

When by gravitation from on high the liquid is pressed down till in earth it reaches that point where, from underneath that gravitation again recoiling in a centrifugal direction, again drives the liquid upward, it again from underground rises in the shape of springs to the surface of the earth, where general converging gravitation stops it from rising further, except when, by tubes from the pressure of converging gravitation

screened to a greater height, it is made by menns of these tubes to conquer and pierce athwart that converging gravitation to a greater elevation.

When a mass of liquid is, by decombining electricity or heat from underneath, so penetrated as partly to distend in vapour, that vapour becoming lighter than the surrounding liquid remaining, is driven out from amongst it upward, and the surrounding liquid, not yet reduced to vapour, is now by its superior gravity made to fall in the place of that already reduced to steam, till the whole, reduced to vapour, is made to rise and escape; and it is by the distending force of decombining electricity penetrating the water, which it reduces to a state of vapour, that this vapour acquires the power of driving other objects more solid and cohering collectively outward and upward with such great force.

The peculiar feel of liquidity, different alike from that of gas and that of solidity, only proceeds from liquids, though heavier and denser than gas, still by the want of cohesion in their molecules being made to press in the pores of the body so much further than cohering solids, without either by their collective weight bruising, or by their penetrating mass dissevering and lacerating this body.

Substances whose component molecules already have forms somewhat different, though still in a liquid and uncohering state, may be left to be

by their weight pressed forward by the side of each other, so as to flow separately, though by no intervening partition kept asunder, as we see in the waters of different rivers when united without mixing; and in the different saps of vegetables, and fluids of animals, while in that embryo state in which between these different streams have not yet been consolidated the parietes of those vessels that increase their separation.

Substances still liquid, but denser and heavier, and with fewer interstices than certain more cohering solids, may not only yield to a pressure to which these solids, more cohering but more porous are not liable, but may even support, and, when pressed forward, carry along with them those solids, as we see in the solid molecules carried forward by the blood, and the vessels wafted along on the water.

As of some substances the particles may themselves acquire greater cohesion, or contain other particles more cohering, in greater quantities than other substances, liquidity or yieldingness to pressure, and solidity, cohesion, and power of collectively resisting that pressure are relative terms. Compared with water, oil, which in the midst of that water conglomerates in flakes more tenacious, already is a solid: so is relative to pure water that water which a mixture of soap enables to rise in bubbles able to resist the pressure of the surrounding atmosphere at a

degree of tenuity in which pure water would have yielded to the same. Silex, which by combining electricity and cold is compressed into a cohering solid, by decombining electricity and heat is again distended into an uncohering liquid.

Of all substances first still radiant and next gaseous, but which in their gaseous state probably have electricities so opposite that when mixed they neutralize and arrest each other, and make the molecules, before distended, collapse in liquids, those in their gaseous state called hydrogen and oxygen, being the most early and copious, are those which, on mixing and collapsing, compose that liquid most elementary and copious called water.

Oxygen and hydrogen may already, high up in the atmosphere, in quantities very small and diffused, mix in the shape of water. This water may even there already again be mixed with other gases, as all rain-water already at a great elevation is with a certain portion of nitric acid, which it derives from nitrogen, and as nearer earth it is with other gases, when it becomes mineral.

Like oxygen and hydrogen, other gases may by the removal of combining electricity be left to collapse in other liquids more dense and heavy than mere water, which, like mere water, may again, by the penetration of combining electricity and cold, in greater quantities than that

which is sufficient to reduce common water into the solid called ice, be reduced like liquid mercury into a solid block.

Between the opposite electricities, which, while high up in the atmosphere, balancing each other, first kept oxygen and hydrogen, in their gaseous state, suspended separate from each other, the loss of that balance first leaves particles to collapse in water, in quantities so small and so diffused as thus far still to let through all the light falling from on high, and itself to remain invisible. As this loss of balance becomes greater and more sensible, it leaves these particles of water to collapse still further, to increase in density and gravity, and to form those aggregates called clouds, pressed nearer to the earth, but, in their approximation to that earth, so arresting the recoil of gravitation from the earth centrifugally ascending as to make it accumulate and support these very clouds, during a certain period, in air at a distance from that earth, till, from remaining semi-transparent and letting through the light, they become by still increasing collapsion and density wholly opaque, able only to absorb that light, and to present from the earth a dark and heavy appearance. Sometimes the light accumulates in these clouds till it rends them in twain, and athwart their dissevered body breaks forth in streams called of lightning, which, by the concussion they

cause around them, produce the noise of thunder; and, of the clouds thus dissevered, cause the aqueous particles, thus far still suspended, to collect and to descend in large drops; and not unfrequently, by the separation taking place between the electricity of a combining sort, productive of cold, and the electricity of a decombining sort, productive of heat, the former acts on these drops so powerfully as in their fall to condense them into hail.

At other times, before opposite electricities each come, by their conflict, to the extremity of that complete separation productive of thunderstorms, they cause the aqueous particles, first transparent and invisible in the sky, to collapse in clouds, still by centrifugal gravitation supported in the atmosphere, till by further collapsion, these particles transformed into raindrops are made to descend to the earth, and to penetrate its core. At last, nearer the centre of that earth, by the recoil of centripetal into centrifugal gravitation arrested, the water is again, in the shape of springs, driven up to the surface of the globe, where it again meets with a converging gravitation, by diverging gravitation from underneath less counteracted, and is by the latter driven forward in streams, which run on in a sidelong direction till their contents collect and subside in the deepest cavities at the surface of the globe, in the form of seas. Thence,

by the penetration of decombining electricity and heat from on high, the particles of that water, again separated and reduced to a state of lightness similar to what they presented before they descended from the sky, again in the shape of vapour reascend in the atmosphere; and either again by degrees through the intermediate state of gas return to that of radiance, or through fresh separations between opposite electricities revert to a state of aqueousness and collapsion.

Composed in great measure of hydrogen, itself previously composed of condensed light, water still retains the inflammability of its component elements to such a degree, that it even again communicates the same to its later combination by electricity, in the solid state of ice, which, when forcibly struck or compressed, will emit sparks of light.

Even when on substances already converted in solid bodies water is again poured in a liquid shape, it will add to their combustibility, make them burn brighter, and emit a fire more intense; as long as not poured upon them in such quantities as by its want of cohesion to choke and fill up their pores, and thus to prevent through them that transit of oxygen which is the instrument of their decombination.

Like the substances first radiant and next gaseous, called hydrogen and oxygen, of which the collapsion produces the liquid called water,

there are other substances, first radiant, next gaseous, of which the collapsion produces other liquids still mineral only, such as mercury, petroleum, naphtha; or vegetable, such as the saps of plants; or animal, such as lymph and chyle and blood, before these liquids are again by further consolidation rendered cohering and solid: others are often, like iron, silex, and other minerals, without even reaching the earth or being visible naturally in an intermediate liquid state, already in the very atmosphere, by mixture and by the retreat of that electricity which kept them suspended, from that state of gas immediately converted into that of solidity and cohesion, under the name of atmospheric stones; which, by the density and gravity they acquire, are made to collapse to the earth.

Indeed it is probable that most of the substances, from the state of radiance by the force of combining electricity and cold made to pass into the state of gas, were by the force of decombining electricity and heat again made to lose the separation and fixity of their particles in that state, and to return to that of liquidity, before they assumed that of positive cohering solids; since the present general globular form of this earth, in its cohering state, seems such as it could only from the pressure of converging gravitation have received while in a state of liquidity; and since the highest and most primitive mountains raised

above the general surface of the globe in their present solid state still retain those indentations, and that shape of lengthened ridges of waves, sharp at the summit, more slanting towards the side from which they were pressed upwards, and more precipitous toward that opposite side on which they were again left to collapse, which they could only have derived from a pressure upon them from one side and in one direction while in a prior fluid state; and since the highest summits of those mountains are still found to retain the exuviæ of such animals as could only have lived in their bosoms while their materials were fluid; and since the numerous successive deluges which this globe has experienced prove that, after its kernel was solidified, water still continued to cover a great part of its surface; and, buoyed up on the highest solid apices, only gradually broke through the barriers which there for a time retained it; and thence fell back into the lower reservoirs where it at last subsided.

CHAPTER XXIII.

Of substances first radiant, and next condensed in the form of gas, the further consolidation in forms cohering and solid.

We have seen substances not only from a state of radiance, continuity, rapid volatility, and yielding to the smallest pressure perceptible to us, by the intervening force of combining electricity first reduced to a state of molecules separate from each other, and yet at a certain reciprocal distance remaining so fixed and stationary, as, while by their diffusion still remaining individually imperceptible to the sense, already in collective aggregates to offer to that sense a certain resistance and pressure, such as is presented by wind.

We have seen aggregates of substance from this state, called of gas, in which their portions, by intervening electricity divided, compressed and condensed, remained fixed and stationary at a certain distance from each other, by the withdrawing of this intervening electricity from between their molecules, next collapse into a state

on the one hand of still greater collective density and weight, but on the other hand again of less fixity and stationariness, called liquidity.

But we also again see, of aggregates of substance, either immediately from a state of gas, or more mediately through an intervening state of liquidity, certain particles acquire a fixity, a cohesion with regard to their immediate neighbours, so much greater even than that which they already presented in the state of gas, that even when joined and stretched out horizontally to the earth, and in a direction alike transverse to the gravitation centripetal and centrifugal, in flakes or follicles very spreading and very thin, and receiving the pressures of both these gravitations over a very extended surface, they nevertheless remain able to resist the pressure of both; and to preserve their continuity in a degree much exceeding that in which either of the two pressures of mere gravitation alone enables them to resist the other; and which power of resistance to pressure, so much greater than that derived from mere gravitation, is called the power of cohesion.

This power of cohesion, for instance, the particles of these substances forming water show, when immediately from the state of gas, or through the intermediate state of liquidity, they are converted into the state of spangles of snow, or of sheets of ice; and this power of cohesion the particles of other gases acquire, when they

are combined into the solid bodies of other minerals, of vegetables and of animals.

Some people have explained the power of cohesion by a peculiar hooked form pertaining to the component molecules of all substances, which made those that in a gaseous state still remained separate from each other so to hitch or hook on to each other as to become cohering. They have forgotten that this very circumstance, of their being able to hook on to each other in that way, already presupposes a prior cohesion in the lesser component parts of each individual molecule, which must have existed in them from the first creation of the universe.

Besides, if the component molecules of all kinds of substances invariably and unalterably possessed and preserved this uniform hooked shape, any number of molecules, large or small, first cohering, and next, by subsequent violence again torn asunder or otherwise separated, might again afresh, by mere approximation, be immediately made to cohere as before; which however in general they cannot do, until by a more general dissolution at least a certain number of molecules, as well more distant from as nearer to those first separated, are first from their cohesion released, and restored to a prior state of liberty, liquidity or gas; a circumstance which shows cohesion first to proceed from an action more general and collective than merely that of each molecule singly on its next neighbour.

Other persons, allowing that it is not any attraction from within certain molecules of substance acting on others, which can make these others cohere with them,—that a pressure from opposite quarters, situated all alike outside the molecules made to cohere, is necessary to keep them in a state of cohesion able to resist a pressure tending to separate them,—will perhaps think the compression of opposite gravitations alone adequate to that purpose: but that sort of pressure deriving from gravitation, wherever it acts, is always perceived to act from a great distance, and can moreover from opposite sides only act in a vertical direction, and can only huddle molecules of matter together in round masses or drops; and, coming from a great distance, often has its action by some preponderating interference interrupted; and can, as soon as that interruption ceases, immediately have that action resume its continuance; as we see when the pressure of centripetal gravitation from on high is, by a beam placed horizontally over the surface of the earth, so interrupted as to enable the opposite centrifugal gravitation from the earth upwards by its increased play, to make rain-drops cling to the under side of that beam; and as we again see when that pressure from on high, the moment the beam is removed, again continues as before to drive all the rain on to the surface of the earth—and that sort of pressure moreover derived from gravitation can only act

on molecules of matter collectively, and so as to huddle them together in a lumpish mass; and as soon as, by some external cause, this pressure is made with regard to molecules still liquid and uncohering to change its direction, it makes in its turn these molecules themselves change their situation with regard to each other; whereas none of these circumstances any longer are found to apply to particles of substance, when positively made to cohere; substances only being made positively to cohere by the pressure of a force acting on them perceptibly only from so short a distance that we cannot any where outside these molecules detect it; and yet acting on these molecules so forcibly as to resist a very strong pressure of gravitation tending to separate them; and acting on these molecules, not like the pressure of gravitation, only in a vertical sense, corresponding with that of gravitation itself, but equally in a horizontal sense, contrary to that of gravitation; and while gravitation, by its collective pressure only huddles a certain number of molecules together in the lump, and as soon as it changes its own direction also changes the relative situation of the different molecules pressed together by it, on the contrary pressing each molecule so directly to its immediate neighbours that the pressure may to a great distance, even in a horizontal direction, keep molecules cohering together in very defiance of a strong pressure of gravitation upon them; nay, that

when, by violence, neighbouring molecules have their cohesion broken, the cohesion and the situation relative to each other of the more distant molecules will not thereby be altered.

The force, thus different in its mode of action and pressure from that of mere gravitation, producing mere weight and buoyancy proportionate to the pressure, which produces fixity and cohesion of molecules before unfixed and uncohering, whether in small or large aggregates, can only be a later increase and condensation of that same force of electricity, which, first arising out of the force of gravitation itself, first causes substances thus far still only radiant, continuous and volatile, to be, by its penetration, divided and compressed in the separate molecules more dense and more stationary of a gaseous aggregate.

This force of electricity, after it has thus divided substances of different sorts, and moulded them, according to the different sorts of resistance they offered to its compressing force, into molecules of different sizes and shapes, by still further increase and pressure on these molecules, brings them in certain directions in contact so close and complete, that, offering on those sides no proportionate balance or counteraction to the pressure exerted from opposite sides, where, by the peculiarity of their relative shapes, they cannot be brought in similar contact, the pressure, entirely accumulated on these

latter sides, and unbalanced by any similar pressure on the former sides, suffices to keep them in their peculiar situation with regard to their neighbours, thenceforth fixed, permanent, and cohering, even in spite of efforts, very strenuous and considerable, used to destroy their union, and to drive them away from their neighbours.

And that this circumstance alone forms the spring and secret of all cohesion of molecules of substances in large collective masses,—that all cohesion only arises from the peculiar form of molecules when in a gaseous and liquid state, being such as to admit their being, by the force of combining electricity on certain sides approximated so closely, and to forbid their approximation on other opposite sides to such a degree, as to prevent the pressure on certain sides from being balanced and counteracted by that on the opposite sides, appears since, firstly, any force acting exclusively from one side, without being opposed, balanced, and counteracted by a force acting from the opposite side, even where we do not yet perceive its action, already acts so powerfully, that that of mere gravitation centripetal from without pressing on a ball or globe, from whose inside has been pumped out with air that gravitation centrifugal which might have balanced and counteracted the former, already presses the two hemispheres of that globe, though uncohering with each other so closely together as to require

the strength of a team of horses to overcome this pressure and to produce their separation: Secondly, only in portions of space accessible from without to the force of combining electricity, of substances before entirely radiant or gaseous or liquid, a portion is made to cohere and to solidify: Thirdly, all cohesion and solidification always begins in the portion of each substance nearest the surface often penetrates to no sensible depth within that surface; and when it does, only does so later and more gradually—as we see from the earliest and simplest solidification of mere water into ice, unto the latest and most complex consolidation of saps and fluids vegetable and animal into solid organs. Fourthly, the detached molecules of substances do not seem to cohere in solid bodies the moment they are any how brought in contact; but seem only to be so solidified by a slow and deliberate process, requiring in the electric force much previous adjustment of the molecules to each other, in order to bring them in contact on that side where their forms may fit on to each other closest, before cohesion can take place. Fifthly, when, from a state of liquidity and huddling together in a still yielding mass substances are solidified in a cohering body, they are to a certain degree made in certain directions to separate and to extend so as to render their aggregate, proportionately to its size, less dense, less heavy, more elastic and lighter than it was before; and when

from a state of liquidity, within the pores of a prior substance already solidified, this new substance, before liquid, is made to solidify, the force which causes this expansion and solidification often by its action causes the former solids to burst asunder, as we see in stones in which water becomes congealed; circumstances which can only arise from substances, when solidifying, again being driven further asunder. Sixthly, in proportion as cohering bodies, by being composed of substances more varied and complex, may be supposed to be composed of molecules more different in size, shape, pores and parietes, they offer, with greater elasticity, greater cohesion; as we can see in comparing these attributes in a flake of ice, with the same attributes in a hair; which circumstances can both only arise from the greater number and variety of interstices in the substance of the latter when solidified. Seventhly, the cohesion in a smaller space and number of molecules dissevered can often only by the intervening dissolution of a larger mass of molecules beyond those dissevered, again be restored; a circumstance which can only arise from the first particles dissevered having suffered so much of the force contained between them to escape, as to render it necessary to draw out part of that still imprisoned in the parts as yet remaining in a state of cohesion, in order to re-establish that force of cohesion between the others. Eighthly, of certain

substances the molecules cannot be made immediately to cohere at all, and can only through the means of other different substances interposed be made to cohere; and of the substances that can be made immediately to cohere, some cohere less firmly than others; circumstances which must depend on the peculiar forms of the molecules of different substances affording the electric force which cements them together less or more means of so making them fit together, that its pressure from one side shall more preponderate over that from the opposite side. Ninthly, of most substances still only gaseous, and thus presenting their molecules still only on all sides fixed further asunder, the dissolution into radiance takes place by sudden detonation, while only of a few substances already in state of more cohering solidity the unravelling continues to take place by rapid explosion, and of the greatest number the decombination is only effected by more gradual combustion or putridity; a circumstance denoting that of the combining force of electricity which kept these molecules fast wedged together, the unravelling and exit, which again liberates them from their confinement and leaves them to be driven asunder, has different degrees of tenaciousness and leaves different degrees of facility to be counteracted or defeated.

If, however, the causes here alleged for the cohesion of the molecules of substances in solid

bodies should not be deemed sufficient for the effect produced, I frankly own I can find none other,—must leave the precise way in which this cohesion takes place among the arcana of nature still undiscovered, and must content myself with only in general asserting, that cohesion appears an effect of combining electricity, since on every side it is preceded and surrounded by that electricity.

But in whatever way combining electricity, of substances, in the first instance purely radiant, causes certain portions to be first divided from others, and next combined with certain of these others in aggregates so far still only gaseous, and ultimately to cohere with these others in more extended solid bodies: and whether, while these consolidations of substances are going on more rapidly, they emit, under the name of congelations, a cold very intense; or whether under the name of other formations mineral, vegetable or animal, more slow, they emit a cold less intense, or even totally imperceptible to senses such as ours: whether they end in forming solid bodies of mere ice, or others more complex still merely mineral, or, in fine, bodies organized vegetable and animal, I equally believe it to be the same force of combining electricity, productive of cold, and in bodies endowed with sensation, of a feel more or less intense of that cold, which alone causes these combinations and consolidations;

—which alone converts these substances, first merely radiant, not only into ice and other mere congelation, but into every other form of a cohering sort more complex mineral, vegetable and animal; because many consolidations even animal are still accompanied by a strong emission of cold—witness that which takes place in a human body in vigorous health, when, after a good digestion, the food taken into the stomach is reconverted into the substances of the body; and because in the liquids in which these consolidations are more easily watched,—such as that of water, of milk, and of blood,—they are accompanied by those vibrations, those pulses, those radiations, those retractions (*tiraillemens*) in opposite senses, which betray the agency of electricity; and because in all consolidations mineral, vegetable and animal, from the simplest in mere ice to every later sort, the solid form most early and elementary and simple displayed —that of the recombination of which all solid forms later and more complex and more partial are composed—is that form of a cellular description, showing alternate solid particles and intervening interstices, only again later by their aggregation composing follicular masses, and by their still later compression and convolution vascular tubes, which only arise out of the agency of radiating electricity.

And I believe that it is only because that

combining electricity, when it still only finds gases so early and so coarse as simple hydrogen and oxygen to act upon and to connect together in a cohering mass, is itself required to be collected and condensed very powerfully, before it can so act as to become directly perceptible even to senses such as ours, that the combinations of those solids are accompanied by a sensible cold, and are called congelations; whereas when that electricity finds gases more numerous, more varied and more fine to act upon, and lay hold of, and combine in later solid bodies mineral, vegetable and animal, it is able on these to act in subdivisions so much finer and more diffused, as no longer to remain in the shape of cold perceptible to our present senses; but to suffer the agent to remain concealed, while his work alone becomes perceptible.

I believe the circumstance of combining electricity being in this, and probably in other secondary globes by a gravitation more oblique and unbalanced made in its turn to press upon substances in a manner so uneven, oblique and partial, as by degrees to prevent their further circulation, and to cause them to be in certain places so wedged together as to remain for a time fixed, cohering, stationary, torpid and unyielding to pressure, in their turn to impede the circulation of light and of other elements still radiant, and by their arrestation to produce

partial obscurity and suspension of life, is only an effect of the oblique situation of this, and of those other secondary globes, with regard to the centre of the first and most general and central gravitation. That this arrestation and torpor of component elements thus is a circumstance which only exists in globes of a later secondary sort, only situated more obliquely in general space; and that in globes formed by a gravitation of a converging sort more equally from all sides pressing on their centre, it cannot exist;—an opinion confirmed, on the one hand, by our sun appearing composed of substances less dense, less stationary, more replete with light and life; and on the other hand, by our moon appearing more solid, more stationary, more lifeless, than our own globe.

Be this as it may, the degree of condensation at which on this globe electricity of a combining sort is capable of causing substances still radiant, gaseous or liquid, to be congealed with such an emission of cold as to us are perceptible, is called the freezing point; but it must be evident that that degree must vary according as the substances are of a nature to be by electricity congealed with more ease or more difficulty. Some substances, like gold and silver, are already found in a solid, and we may say frozen state, to which they were probably reduced from a prior state of gas, at a degree of cold so small as to

be to us still imperceptible; while others, like mercury, can only by a condensation of cold so strong as to be most sensibly frozen and reduced to a cohering mass. The gases that by their union form water seem in their state of water to preserve the medium between these two extremes.

After electricity productive of cold has already, in substances before fluid, penetrated in sufficient quantities to congeal and solidify them to a certain degree, it may still continue to rush into them in so much greater quantities as to render their cohesion and consolidation more powerful, tenacious and firm; and consequently to enable them, while congealed, again to give out a great quantity of cold, and yet themselves to retain a sufficient quantity to remain cohering—as we see in a lump of ice which, dropped in a pail of water, may cause of that water a part to freeze around it, without itself wholly dissolving.

Electricity, when it penetrates within and solidifies substances, may become in these so concealed as to remain in them imperceptible till they are again entirely dissolved,—as we see in salt which, when conglomerated into large crystals, may again be pounded into mere dust, before from that dust the cold be again so emitted as to leave it to dissolve and to melt. From substances by electricity congealed, as water is into ice, that cold may again be emitted and

made to pass into and congeal other neighbouring substances; and from the quantity of cold absorbed by salt when consolidating, the addition of salt to water will of that water hasten the congelation, and the later communication of cold and congelation to other more distant substances in contact with that water.

Electricity productive of cold and combination will, while through an atmosphere fine and dry it passes more rapidly and with less obstruction, by so doing be left to fall and accumulate on solid substances which arrest it so much more rapidly and copiously, as, while less felt in its transit, to congeal those substances on which it falls faster and more firmly; on the contrary, while through an atmosphere more dense and damp it is made to travel in less quantities more slowly, it will in its transit be more sensibly felt, and in the substances gaseous or liquid, by which it is finally arrested, cause a congelation less rapid and less forcible.

Where from certain substances, as from iron, cold is emitted rapidly in great quantities at once, its emission will for a time be more felt, but sooner by exhaustion cease: where from certain substances, as from wool, cold is emitted slowly and in small quantities at a time, its emission will, in equal quantities, be less sensibly felt, but last longer, before it again ceases.

CHAPTER XXIV.

Properties of Solids.

Of substances of different sorts, molecules, not throughout mixed and added to in proportions and situations relative to each other such as are similar, may already by combining electricity be made to cohere in solid bodies, resisting the forces employed to detach their component particles from each other; but in this case these bodies cannot yet, when solidified, throughout present substances, forms and faculties homogeneous and similar, such as we call regular crystallizations.

Only when of different substances the particles are throughout intermixed and combined in proportions definite and similar, can the bodies they collectively compose throughout present substances, forms, and faculties of that homogeneous sort, which constitute regular crystallizations.

Only when of substances the molecules, made thus to cohere in homogeneously crystallized masses, are not yet so varied and fine as to re-

quire forces of electricity very complex, and frequently crossing each other, to tie them together in cohering bodies, do these bodies, though increased to any size and thickness, continue to let through all the light that falls upon them, and to remain themselves transparent: but while thus of substances the molecules are still made, by forces of electricity more simple and less crossing each other, to cohere in dispositions such as easily to let through the light, do they also still remain more easily dissevered, more brittle.

When, on the contrary, molecules more varied are, by electrical forces more variously and closely crossing each other, so firmly interknit as more to resist and reflect the light that falls upon them, they become, even in smaller and thinner plates, more opaque and more coloured; and, being tied together by forces of electricity more able to yield and to extend in any sense without suffering total disruption, they become at the same time more malleable and more susceptible of being, by pressure from without, extended without losing their cohesion: as we see on comparing transparent spars with opaque metals.

Substances solidified into cohering bodies may, by the different forms in which their collective mass may be moulded, the different pressures it may be made to exert over, and the different

resistances it may be made to experience from other different and distinct cohering bodies, be made to show the different forces and faculties called mechanical; such as those of the hammer, the wedge, the lever, the peg, the plug, the beam, the arch, the pendulum, the pivot, the wheel, the screw and others partly of propulsion and partly of attraction, and among these latter, where, of the bodies cohering and solid some are very pliant and others very inflexible, and where the former are made to circulate round the latter, those of the pulley.

Substances solidified and cohering may be made, by their parietes, so to screen their intervening pores from the pressure of the centripetal gravitation from on high descending, as to give to the centrifugal gravitation from underneath ascending, within these channels a more unobstructed play; and to make this latter gravitation from within the body of the earth drive to its surface, and even from its surface into detached bodies situated over the same, fluids and liquids; which thus are made to rise in a mode wrongly called of capillary attraction, till they become exposed to and resisted by the full pressure of centripetal gravitation; as we see in the springs rising from the earth, and in a sponge held over a body of water.

Where through the pores of a solid body is made to rise above its surface a new fluid, this

fluid may, above the former solid, either alone, or with some other new fluid from on high descending, be, by the pressure of combining electricity, consolidated into a new solid, cohering with the former, which shall in its own substance, forms, faculties and crystallizations be homogeneous throughout, but at the same time wholly different from those of the former body on which it is superstructed.

While of the properties of mere gases acting on each other, on liquids, or on solids, the science is called that of pneumatics, and while of the properties of mere liquids acting on each other and on solids the science is called that of hydraulics, of solids acting on each other the science is called that of mechanics.

As the gases called oxygen and hydrogen are on this globe among the earliest, the most copious, and the first, by electricity so combined as to lapse in a state of liquidity, under the name of water, and to be compressed into a state of solidity, under the denominations of hail, snow, sleet and ice, we must suppose that, of solids, snow and ice have on this globe been the first. The whole of the solid body first within the atmosphere of this globe composed must have been a snowball, before this snow-ball afterwards became covered by strata of other solid masses more dense, more complex and more durable.

And this opinion seems confirmed by the

later and more superficial component strata since formed nearer the surface of the globe themselves. These strata present fractures and obliquities of position, which prove that, after having first been formed in a horizontal direction, and supported by the prior ones formed under them, they have only by the subsequent melting of these more internal masses of ice or snow been made again to give way, and frequently to collapse, till their fragments stood on edge.

CHAPTER XXV.

Of the forces of electricity certain modifications more partial than those thus far described, which show themselves in certain substances when solidified, and are called magnetic and galvanic.

I SUPPOSE the magnetic force only to be a later, lesser, and more partial offspring of the electric force, acting on certain substances, after these have been, by an earlier and more general modification of that electric force, condensed and combined; inasmuch, as the general attractions, or rather propulsions of the magnetic needle towards the poles seem connected with the peculiar lights at those poles by electricity produced, and as the magnetic pressure seems sensibly influenced by the partial accumulations of that decombining electricity, which elsewhere produce thunder-storms, earthquakes, and other electric phenomena.

As I disbelieve that any solid bodies can really attract or draw other solid bodies after them, otherwise than through the medium of intervening solids, I believe that where a magnetised body has the appearance of doing so, it is in

reality only by repelling and dispelling other forces which previously prevented the body seemingly attracted from obeying the force that impelled it in the track of the former body.

The force of magnetism often, by exerting on solids a pressure, not direct but oblique, causes in small bodies a rotation similar to that which centripetal gravitation produces in the largest globes.

In certain substances and bodies the magnetic poles that existed at first are frequently, by the partial influx of fresh electricity and lightning, again subsequently changed. A combination of zinc and silver often affects the magnetic needle, and different streams of magnetism are often each by the other so alternately arrested and broken through, as to cause certain objects to be alternately driven forward and backward.

Like the magnetic forces, I suppose the galvanic forces only to be an offspring of electricity; or in other words, only to be electricity, through the medium of certain substances of a solid sort more partial and complex so remodified, as to be made on certain other substances to act in a new way. It seems to be the force of electricity so directed as to be manifested in peculiar substances, which in certain entities contribute to the composition of those organs called nerves, the instruments which of external objects and events receive and transmit sensations, and the

thoughts and volitions which these sensations in their turn produce.

Even after the death of an entity that has felt, thought and willed, the galvanic fluid, without being any longer conducted through the organs of sense, thought and voluntary action—without passing through the brain, and causing actual sensations, ideas and wills,—on only being, directly from without, poured into the muscles of the face, body or limbs with which the nerves from within communicate, may in these muscles still produce, though less perfectly, some of those very movements and contractions, which, when that fluid passes, while the body is alive, through the peculiar organs adapted for the purpose, and causes in these organs actual sensations, thoughts and wills, are only of those sensations, thoughts and wills the later effects and manifestations.

Of the origin and composition of the magnetic and galvanic fluids, and of their movements and influence on bodies, the science is still in its infancy.

CHAPTER XXVI.

Sound.

THOUGH I have already described the radiances which cause in us the sensations of sight, of feeling, nay, of taste and smell, because I conceive of those radiances the first origin already to precede even that of the most primary globes, and thus from gravitation and from electricity in unbroken continuation to descend to these primary globes, and from these again to our secondary globe, so as to precede in the formation of the latter that of the very substances more solid, even still merely gaseous, which we recognise around this globe, I have not yet touched upon the radiances which cause in us the sensations of sound, because I consider these peculiar radiances as only arising out of, and following the prior formation of substances at least gaseous; and thus consider that even, if the immediate causes of sensations of sound might already exist in primary globes, they must again die away entirely in the intervals of space separating these primary globes from more secondary ones, in which substances emanating from the former again diffuse themselves into a state of mere radiance, and which they

traverse in that state of mere radiance, before around secondary globes they again become more condensed; because I consequently consider the music of the spheres, such as might be heard from one globe to another, to be one of those poetic fictions of the ancients which, inasmuch as impressions made on mere radiant forces cannot yet in those latter forces produce any vibrations perceptible to human ears, cannot yet have any reality in nature.

In our sun, in fact, one of those more primary globes, which, from the greater centrality of their situation with regard to surrounding space, can only from that surrounding space receive pressure of gravitation, of electricity and of other forces more even, more balanced and more direct, substances cannot probably yet through pressures more oblique, more partial and more preponderating be compressed so as to offer condensations, and to experience shocks and vibrations, such as are necessary to produce sounds.

Nor in such globes as our sun can the production, the propagation and the sensation of sounds yet be required for the information, the guidance, the welfare, the happiness of any even of their most sentient tenants.

The same centrality, and security from any partial pressure, which there must prevent in substances the arising of sounds, must there also prevent the different substances themselves pro-

duced from being so partially collected, as to be divided among genera, and in each separate genus, among individuals, distinct from each other; and among individuals no longer all alike throughout to every radiance so pervious as to render through the mere movement of light —through the mere impression of sight—every entity instantaneously aware of what happens in every other entity near or far. It must there prevent in certain individuals partial obscurities and ignorances of the impressions, sensations, thoughts and designs by other different individuals harboured against them; the effects of which they can only through the vehicle of sound be made to guard against and to obviate.

In such primary globes no sounds of distant thunder can be necessary to warn any of their tenants of the approach of those storms, which there cannot exist: no howling of beasts of prey can be required to apprise any of their inmates of the vicinity of those beasts, which there cannot take place: no cries or language of man can be wanted to inform other men of the desires of the former, to the accomplishment or prevention of the effects of which the concurrence of others is necessary for mutual advantage.

Every thing that is to be sought, or to be dreaded—if any things of the latter sort still exist on such globes—must there, by mere in-

tuition, and without the assistance of sound, be directly known.

But not so in a secondary globe like ours. On this globe, where the more uneven and unbalanced pressure of elements still causes the arising of numberless genera and individuals simultaneous and successive, wholly distinct and separate from each other, and by intervening obstructions prevented from each knowing by intuition what passes in the body or mind of others, the vibrations of sound are constantly required to give others notice of events that produce no direct impression on their senses of feel and sight, and that should nevertheless be communicated from one entity to the other, for the well-being of both. In this globe those vibrations of sound alone can, of many movements, wants, desires and intentions that arise in the bosom of one individual, give timely notice to another individual, interested in promoting or preventing their effects.

And on such a globe as this, the very causes that must produce the necessity, the want of sounds, would also produce in certain entities the capacity of emitting, and in others that of hearing such sounds.

While forces and substances still merely continuous and radiant have not yet in themselves even here intrinsically sufficient condensation, and extrinsically and around them sufficient room

to give and to receive from other substances pressures, shocks and vibrations sufficiently strong, dense and abrupt yet to produce and to propagate sounds, as soon on the contrary as forces and substances already by electricity are divided into molecules more condensed, separate from each other, though still only gaseous, when of these molecules a certain mass, by that electricity further pressed, is made to come in sudden contact with and to press upon and to produce a shock in another mass, it may already in this other mass produce those vibrations more abrupt, more dense and more close, which are called sounds, and which produce sensations of such.

These vibrations, productive of the sensation of sound, we already perceive high up in the atmosphere, when electricity produces on it the more diffused glare of aurora borealis or australis, accompanied by an abrupt and crackling noise; or when the same electricity produces lower down the more condensed streams of lightning, accompanied by the more continuous roar of thunder; or when that same electricity again, by distending and moving certain masses of air, causes the howlings of the wind.

Even liquids, notwithstanding the greater collapsion, density and yielding of their component molecules, may still, to a certain degree, receive, continue and transmit these vibrations; but it is especially where molecules are more closely

interwoven in cohering substances, of which the solid parietes alternate more densely and regularly with the intervening interstices, that these vibrations of sound are produced and transmitted with so much less interruption,—so much greater equality, rapidity and closeness,—as to acquire infinitely greater loudness and distinctness.

From the spot where, by certain pressures and shocks, those vibrations are first produced, they are on all sides around propagated and extended to further distances in radiating directions. Already when to mere inanimate solids they are so communicated as to make the dust lying on these jump about, they cause this dust gradually to accumulate in distinct ridges, wider or narrower, according as the vibrations are of a nature to produce in the organs of hearing sounds more deep or more acute. They make houses shake and windows rattle.

These vibrations, even when through the medium of fluids or solids only yet communicated to the sense of feel, are by this sense already perceived, as we may see in an oyster, already by the vibrations of thunder made to gasp and to open its shell, though it be yet unpossessed of any organs of hearing; and as we may see still more forcibly in ourselves, when we experience the vibrations of thunder, or those which a gun fired, or an organ or harmonica played upon,

communicate to surrounding air, and through this air to the human frame.

Finally, these vibrations, when reaching in entities those organs of sense more complex and fine, capable of receiving from peculiar movements the impressions more condensed, distinct and diversified which are the media of sound, produce in those organs the peculiar sensations called of sound.

As the various substances existing in nature, when by electricity divided and compressed in distinct molecules, are moulded in molecules of size and of forms very different from each other, these substances, when sufficiently compressed to receive from the pressure of electricity or of other substances the vibrations of sound, receive vibrations in their nature, their dimensions, their direction, so different from each other as to become very different in their impression on the organs of hearing. This we may already perceive in those produced by mere wind or by water, by mineral, by vegetable, or by animal substances; by strings of metal, or cords of catgut; by the external limbs of lower animals, and by the internal organs of voice of higher brutes and of human beings.

And, according as by other substances moulded into peculiar forms, the rays in which these vibrations are formed and propagated, again are

made to become more diverging or converging, diffused or condensed, refracted, reflected, conducted, or made to cross or to be crossed by other rays, or ultimately are so attenuated or absorbed as again to become imperceptible, they are heard in different degrees, or in different directions; as we find in the vibrations of sound, by speaking trumpets, by whispering galleries, by echoes, by ventriloquists, and even by musical instruments in unison with other musical instruments situated at a distance from them, received, collected and reverberated.

However, while light and colours, being substances, may in their radiant state be arrested; and, though becoming stationary and quiescent, and consequently latent and unfelt, still remain existing and ready to be again directly diffused, rendered volatile and able to reach and to re-impress the sense, sounds, only the effects of forces, of movements, cannot become latent and still continue to exist. As soon as the movement which is necessary to render sounds audible ceases to exist, the sounds must cease with it, and cannot without fresh movements be revived.

Sounds, however, having, as such, to perform between the molecules of substances that form and condense them sufficiently to be audible, a vibratory motion, before they perform a radiant and forward movement, are in their progress so

much slower than radiating substances, such as light and colours, that when both depart at the same time from the same point, the light soon gets the start of the sound, which presently lags so far behind, that of a distant clap of thunder, or a distant explosion of gunpowder, only long after the light has ceased striking the eye the noise first reaches the ear.

As I have already observed that only when substances become, by combining electricity, so compressed as from a state of radiance to pass into a state of gas, they first become able to experience and to propagate the vibrations of sound, it can only be that electricity of a combining sort, causing the effects and the feel of cold, and the combination by it of substances before radiant into a more condensed and solid state, which can be called the immediate parent of all the primitive sounds that arise out of such combinations, from the simplest crackling of aurora borealis, and peals of thunder, and rustlings of wind and roar of waves, to every most sonorous and dulcet production of the human voice and of music. The same decombining electricity, as we shall see, being the parent of all decombination of substances, whether in the way of detonation, explosion, effervescence or combustion, can only be the parent of all the vibrations of sound that issue out of these latter.

According as more or less of substance are con-

nected more distantly and loosely, or more closely and firmly, the vibrations which when pressed they receive, and which in their turn produce sounds, will be more wide, more lax, more obtuse, more slow in time and space, and produce sounds more deep and blunt and sluggish, or they will be more short and rapid, and produce sounds more sharp, more acute, more numerous and more piercing: and while, in the former case, if forcible, they will only by their pressure from without compress, and stun the organs of hearing, and deprive them of the power of moving, in the latter case they will penetrate them so as from within to lacerate, to dissever, and to destroy them.

In the same way as certain modifications of substance, said to be peculiarly dry to the feel, or certain modifications of flavour, said to be very astringent to the palate, only become irksome to the sense by drawing out of their organs the fluids already poured into them, so likewise certain vibrations of sound, such as that produced by cutting a dry cork, or by pressing a dry spunge, only become painful to the ear by the contractions they cause in the organs of hearing.

As electricity productive of combination and cold is the first modification which immediately converts substances from a state of continuity and radiance to that state of distinct molecules necessary to receive and to transmit the vibra-

tions of sound—as electricity productive of decombination and heat can only at second-hand produce in these molecules, while again decombining, vibrations of sound more loose and lax, the countries and climates in which combining electricity most prevails, and the seasons in which it reigns most exclusively, are those in which an atmosphere most elastic and dry is productive of sounds more clear and distinct. Those climates and seasons, on the contrary, in which electricity of a decombining sort and heat are most experienced, and produce most relaxation, humidity, and dissolution, must in objects weaken and destroy the capacity of producing sounds clear and distinct; must render them able only to emit sounds hoarse and deep.

In regions at once very hot and very humid, the very cries of beasts, the notes of birds, and the voice of man are less silvery and sonorous, more hoarse and croaking, than they are in those where the air is more elastic and dry. No nightingale pipes in the swamps of Berbice: no Catalani sings on the banks of the Niger: the substances of nature are less sonorous, and the instruments of art sooner out of tune.

As, however, we already have seen that radiations of heat and radiations of cold, both very intense, are very compatible with each other, there are places very hot, where cold may produce objects capable of emitting sounds very clear and very diversified.

CHAPTER XXVII.

Forces of electricity of a decombining sort, or of heat.

I HAVE said that though forces of combination must, in their effects, precede forces of decombination, yet the earliest and simplest actions and effects of the former might already be followed by the earliest and simplest actions and effects of the latter, even before these former themselves had evinced actions and produced effects more late and complex: that thus, even before the forces of combining electricity or cold had yet converted any substances from a state of radiance into a state of gas or solidity, forces of decombining electricity or heat might already decombine these substances from a state of radiance more dense and close into a state of radiance more loose and diffused.

But I have, nevertheless, deferred the description of the origin and action and effects of decombining electricity or heat, till I had carried the account of the origin, action and effects of combining electricity or cold somewhat further than its first commencement, in order to render between the two modifications, having a common source, the later difference somewhat

more marked and distinguishable. I now proceed to the account of the latter force, which, though it arises out of the former, arises out of it somewhat later.

Though of the force of decombining electricity or heat the effects and the feelings be entirely opposite to those that proceed from the force of combining electricity or cold; and though I believe them in their first origin to have even been later and more internal than those of cold, yet I believe them to have, like the forces of combination and cold themselves, originated more proximately out of forces of electricity, and thus to have originated more remotely and mediately out of forces of gravitation; because, even in the depth of winter, and at night, when no actual rays of heat more condensed from the sun can reach that portion of our earth turned away from it,—while, consequently, electricity alone seems to pervade the atmosphere, after a degree of cold so severe as under the name of frost to cause all surrounding matter thus far fluid and gaseous to become solid and dry, there often suddenly arises in that very atmosphere a degree of heat so great as again to thaw and dissolve those substances, by that cold erst combined and congealed; and again, from a state of congelation and solidity to make them return to a state of liquidity, vapour, gas and even radiance; a phenomenon which,

under those circumstances, can only be attributed to a sudden change in the electric state of the atmosphere itself:—and because, even at night, a thunder storm only arises from the modification of electricity causing cold and condensation, first throughout by the modification of electricity causing heat and dissolution so balanced that each retains its place intermixed with the other, subsequently being by the latter so overpowered that they separate; and that while the electricity causing cold and condensation, again driven up and made to accumulate in the higher regions of the sky, there congeals the aqueous particles into hail and snow, the other electricity, causing heat and collapsion, descends to the lower strata of the atmosphere, and there makes the particles of humidity, before diffused, collapse in vapours, clouds and rain.

Nay, I believe the forces of electricity productive of decombination and heat to have more immediately arisen out of the forces of electricity productive of cold and combination themselves: I believe the forces of electricity which, while from more distant points without approaching, and pressing substances enclosed withinside them to each other, produced withinside themselves, and upon these substances, the effects of cold and combination, when met, and again by the shock of meeting made to recoil outwards, and to drive substances situated outside

them from each other, to have themselves on these substances situated outside them produced the later effects of heat and decombination. I believe the ignition and inflammation by heat caused, only to arise from the evolution and return to volatility, to radiance and to transient visibility, again by the expansion of heat produced in those very particles of light, which by prior cold had, from a state of volatility and radiance and visibility, been reduced to a state of solidity, cohesion, quiescence and invisibility, because the march and progress and effect of the electricity causing heat and decombination, though directly opposite to the march, progress and effects of the electricity causing cold and combination, seem to arise immediately after and out of those of the former electricity, and to become more striking, as more striking effects of the former electricity have preceded them.

Thence rays of heat, arising out of the clashing of rays of cold, and their recoil outward from a common centre, may, even in the sun, only after a time begin to be connected with later rays of cold, and may, from all points of space do what we have already seen them do; namely, cross and be crossed by rays of cold; and in certain points of time and place contend with and conquer or be conquered, by those of cold, and either displace them, or be displaced by them.

On our globe, sometimes both heat and cold

alternately experience such excessive and preponderating condensation, that in India, while in the day-time the heat from the sun is quite unbearable, at night the cold freezes the water in the tanks; and any where cold and heat may be made from opposite quarters to radiate to peculiar spots in such quantities, that after crossing each other, the former shall congeal a plash of water into ice, and the latter liquefy a block of ice into water, side by side.

But when rays of cold and rays of heat fall, whether it be in small or in great quantities, at the same time, on the same spot, the preponderance of either will drive the other away.

Some substances by little cold from without made to solidify and to cohere, but in solids and bodies of which the component parts are little tenacious, will again by little heat be made to dissolve and to return to a state of gas or radiance. Mere percussion will in some bodies drive sufficient decombining electricity and heat for that purpose. Other substances, requiring more cold to make them solidify and cohere, will also require, when solid and cohering, more heat to drive out the cold and make them dissolve. While most gases are made by little decombining electricity and heat to rebecome radiant most rapidly, most metals are by decombining electricity and heat only when most condensed, most slowly again from a state of solidity and

cohesion first made to experience the more partial decombination of melting; and only fresh oxygen poured in among their particles can facilitate their more gradual but complete dissolution into mere radiance.

Where substances very different have by the converging pressure of combining electricity and cold been first from radiant combined together in bodies gaseous, liquid and solid, the diverging pressure of decombining electricity and heat sufficient to cause some again to separate and from solid to rebecome fluid, may not yet be strong enough to produce the same effect on others; and in that case, while the former, when returning to a state of vapour, will rise and escape in on high, the latter will only collapse and fall to the ground in ashes. As substances, before by cold combined and consolidated in gases, liquids or solids more loosely or firmly, are by heat again decombined more rapidly or more slowly, the decombination is said to take place in the various ways called of detonation, explosion, combustion, effervescence, fermentation or putrefaction. As their distension and dissolution is more rapid and forcible, or more slow and gradual, it causes in the particles of air around a vibration and a displacement productive of a noise more stunning or more subdued.

Liquids are by heat dissolved and separated

less easily than either gases or solids; because their molecules being less fixed and stationary, the first that are dissolved have the voids they leave so immediately filled up by others still undissolved, which gravitation impels to take their place, as every where to obstruct the progress of heat, and to prevent the passage of the force of decombination,—every where of this latter to impede the thorough draft.

Substances gaseous and cohering, presenting between their solid molecules interstices disposed in peculiar orders and directions, will through these interstices conduct the electricity productive of heat in peculiar ways. Thus it is, that through different strata of air, piled one upon the other, we see decombining electricity and heat chase the light it causes to decombine and to be evolved, before it, in the shape of thunderbolts, or, of what is called forked lightning, alternately in one direction and in another opposite direction. Thus it is again, that on board of a vessel the electric fluid will be made unaccountably to dart by certain substances and objects, without singeing them, while it wholly destroys certain others,—that it will spare a man's integuments, while it reduces to ashes his vitals,—that it will sometimes in his nervous ducts, before pervious, cause such derangements as in these to obstruct all power of sensation or or movement, and at other times will again in

these ducts already deranged remove the obstructions produced; and cause a man, become deaf or blind, to be again restored to sight and hearing; a man disabled by palsy again to recover his power of movement.

It is from the radiance of electricity and heat travelling most readily in the direction in which it meets with least impediment, that it travels easier from the body of the globe outward and upward into the atmosphere, than from the surrounding atmosphere it travels downward and inward into the globe; and that fuel is easier kindled from underneath than from above.

I have already observed that heat, made from underneath to penetrate into liquids, by first expanding their lower molecules, and causing these by their increasing lightness to rise, while others from above, remaining proportionably heavier, sink in their place, in these liquids causes eddies.

The first degree of heat, beyond that which only from within so uplifts part of a mass of liquids, as to make it bubble up and overflow its bounds, makes these bubbles burst and separate in vapours; and it is only because vapours still have cohesion enough to keep heat to a certain degree imprisoned within them, without being permitted entirely to escape and to be dissipated in surrounding space, that that heat, by its own distension causes the vapour to distend, and

to drive other surrounding bodies before it with a force which, when it is itself entirely dissolved in gas or radiance, and suffers heat entirely to escape, it again loses.

The expanding power of heat which drives gases on all sides and in all directions before it, when it causes these gases to be in their flight greatly accumulated, causes them to exhibit in peculiar directions that increased pressure called wind; which, from where the penetration of heat first produces it, blows alike in opposite directions, but which at a further distance from its origin appears only to blow in a single direction; and often from accumulating, with gases, the cold these contain, increases that cold, though sometimes, from conveying along more heat, it also increases the feel of heat.

Often in different strata of air arise at different points different foci of wind, which at different distances from their first source are seen to blow in different and opposite directions.

Where, from peculiar causes, at peculiar periods, and in peculiar regions, electricity and heat are made to drive the atmosphere more constantly in peculiar directions, they cause what are called trade winds.

Where a wind in its progress in a peculiar direction is, by a contrary wind coming from the opposite side, so resisted as to be made with it to

move in an eddy of its own, it is called a whirlwind.

When in an atmosphere charged with vapour, heat from different quarters makes that vapour so distend as in other quarters again to collapse, and by its own weight to fall to the ground, it forms what are called heat drops.

Where in bodies, partly liquid and partly solid, heat penetrates sufficiently to drive the liquids out in the shape of vapours, without penetrating sufficiently to decombine the solids, it causes, by the escape of the former, the latter to increase in solidity and dryness so greatly, as to render them less liable than they were before to be by fermentation or putrescence entirely dissolved; as we see in mummies.

After both cold and heat have, to a certain degree, penetrated into substances, the heat imprisoned in them may, with a certain portion of their other component elements, be so pumped out as to leave the cold more to prevail, and to congeal what remains more strongly; as we see in a Leyden jar.

Where of a mass or mixture of different substances, reduced to a liquid state, by the removal or evaporation of part of the force of combining electricity, or by the penetration of fresh forces of decombining electricity, certain sorts are again made, from that state of liquidity, to pass

into a state of gas, this conversion, according as it takes place more rapidly or more slowly, presents the conditions of effervescence or of fermentation. Sometimes, after of compounds certain substances are by effervescence or fermentation thrown off, the remaining ones, instead of being left to subside, again from without take in new gases, which again of the compound change the nature and the faculties.

Of lime, in its dry and solid state, when water is poured upon it, the hydrogen, or heat and light contained in that water, again causes a decombination, in which of that lime, thus far called quick, the acrid and corrosive parts are again made to evaporate, and the others remaining to collapse and subside in the milder, more quiescent, and less corrosive form of slackened lime.

As solid bodies have surfaces more rough and more uneven, these surfaces, leaving heat more room to escape at, leave it from within to escape faster. From a solid body in immediate contact with an expanse of colder external air of indefinite extent, heat will escape faster than it will from a body from which it only is left to travel a short distance, before it again meets with another solid body or envelope, from which it is in part again reflected backward to the body whence it first emanated.

The heat directly, and at first hand, radiating from the sun, seems, on a superficial view, to

have more power of giving plants savour and odour, than that which has already been incorporated in, and is again, by combustion, let out of earthly substances; but this, probably, only arises from the heat directly emanated from the sun coming to the earth accompanied by rays of savour and odour more abundant, and which in their diffused and imperceptible state incorporate themselves with different earthly productions more copiously, than do the rays of heat only at second-hand again emanated by such earthly bodies as those serving for fuel.

Of the heat in the day-time from the sun radiated to the earth, at night, when, of this radiance from without the pressure ceases, a certain portion is from the earth and from its productions again radiated into outer space.

It is because the radiations from the sun, which in the day-time cause particles of humidity to remain detached and suspended in the atmosphere in the state of gas, at nightfall leave those same particles to collapse and to descend in vapours to the surface of the earth, that they then appear condensed in the shape of dew; and it is because thick clouds hovering over the earth intercept and arrest even at night the radiations of heat from the earth upwards, that murky weather, which causes those radiations in that state of the atmosphere still to remain more accumulated near the surface of the earth, causes

in that weather before the morning the dispersion of that dew, which, in serene weather, the more rapid escape of that radiation upwards in the atmosphere leaves condensed near the surface of the earth.

When, within portions of substances, already by electricity of a combining sort and cold combined in solid bodies of a peculiar definite form internal and external, other fresh substances still radiant, fluid or liquid, are from without poured and made to penetrate in such a manner, as within these former solid forms and bodies to consolidate in new solid forms and bodies, attached to these former ones, the substance or body is said to be living. As we shall presently more amply see, no boundary line can be drawn between things lifeless and living.

When, from those new portions of substances before fluid being made to consolidate within, and to cohere with those already solid and cohering, these former solid aggregates derive additional size and extension, they are said to grow. When, the new substances flowing in, while with a part of those already consolidated and cohering they are again made to cohere in solids more extensive, they are at the same time made on another part thereof so to press as again to loosen that other part, to detach it from the former, to drive it out and to make it evaporate, the solid aggregates are said to experience change and

renovation, which already implies partial decombination and decay. When, from the increasing pressure of the new elements from without on those already consolidated within, these latter again, in their turn, loosen and drive more of these substances from within out than are allowed from without to come in and replace them, the decombination, the decay and the waste, become more general; and when, finally, the substances consolidated within are, by the very pressure of former ones from without, disabled from taking in more such, and when, from first being by such renovated, they at last lose their faculties of life and further combination entirely, they are said to die.

People are mistaken when, in substances gaseous, liquid or solid, and decomposing, whether in the mode of detonation, explosion, slow combustion or other, they regard the fire they show and the flame they emit as the instruments of that decomposition; because fire and flame are used to communicate combustion from one object to another.

Many bodies apparently composed of less light than others are by heat again dissolved without emitting any visible flame. In all bodies, the decomposition, by decombining electricity caused, precedes the flame. It is only after this decombining electricity has first loosened and detached some of the portions of the body first formed out

of condensed light, that these portions, again escaping, show themselves in the shape of flame; and flame thus is not the cause but only the effect—the later symptom—of prior decombination. Flame is only the state of transition, or gas, intervening in light between a state of consolidation and a state of radiance. It is, moreover, the vehicle in which the decombining electricity issuing from it, may more easily from one body be conveyed and communicated to another.

Of light and colours, the portions by combining electricity incorporated in solid bodies, and by decombining electricity again driven out of those bodies, while still near to those bodies, retain around them the shape somewhat cohering and distinct of a gas, itself still visible to the eye, called flame. At a further distance from those bodies this flame again becomes unravelled in the shape more diffused of radiance, becoming entirely invisible. When combustion later comes to a close, the intermediate state of gas or flame itself again becomes imperceptible; and objects seem, at once, from a state of a red hot coal to be reduced to a state of radiance.

In vast decombinations of substances, especially in the rapid mode of detonation and explosion, and even in that of more gradual combustion, the particles driven out create such a rush and pressure on the surrounding substances

of air, as in these to produce vibrations and radiations of noise very loud, which we perceive in the clatter of thunder, in the report of a gun, and even in the rustling of wind, and the roar of a violent conflagration.

When electricity and heat, first imprisoned in clouds, break forth from these, and, in their condensed state, strike a body, this circumstance is independent of the lightning by which this thunderbolt is accompanied. This lightning is only the condensed light which the current of electricity again distends and drives before it. The same is the case in the detonation of earthly gases made to decombine. Solids, when by oxidation their decomposition is facilitated, also, whether they decombine in the shape of rapid explosion or of slower combustion, are made to emit, in the form of a flame more transitory or more lambent, the light that was imbodied in them.

The sun—the first great receptacle of the radiance of cold, of heat, of light, of colour, of flavour, of odour and of other forces and substances, within the precincts of our system first formed—is, by the pressure of these elements from within again recoiling outward, of them again at all times made to emanate a great deal. By the coloured canopy of fluids which surrounds the body of this sun, that body seems first from its interior to pour out these substances in the shape of flames, and only at a further distance

from its surface again to unravel them in pure radiance, before, in the latter state, they are made to hie on to surrounding planets. While traversing, in their diffused and radiant state, the unbounded regions of intermediate space, only the rays of cold seem perceptible to such senses as ours: the others appear imperceptible; and only as they approach nearer to, and are again condensed round inferior planets, do they in part again become more perceptible, prior to their absorption by and incorporation in the bodies of these planets.

From the body of this planet, and of the substances produced by the same, especially when and where the pressure of the sun upon these substances seems for a time, during the night, to subside, of the light and other elements taken in a portion seems again to flow out in the shape of phosphorescence; as we see in minerals, vegetables and animals, even while they still remain, upon the whole, in their state of combination: and when these substances again are by decomposing electricity more entirely decombined, that light is again poured out of them in quantities greater and more perceptible.

In many substances, from which mere repletion of heat and light suffices not alone and without assistance to make these elements sensibly emanate, the smallest pressure or friction from without will increase the quantity of that heat

made to penetrate within them to such a degree, as to make it again exude from and decombine the body, and drive its light out, and cause the body to dissolve by detonation, explosion, or combustion. Even ice may be struck so as to emit not only electricity and heat, but light, in the shape of sparks of fire; before certain of its particles, by liquefying, again obstruct the passage of the fire, in some of them kindled, to other particles more distant.

While certain electric phenomena, such as aurora borealis and australis, only appear to proceed from electricity of a combining and compressing sort, productive of cold; and only to arise from this electricity when, compressing certain portions of light and other fluids into solid bodies, it again of these fluids drives other portions from between these former ones outward;—because these phenomena are chiefly seen in polar regions, in winter, and high up in the atmosphere, where cold is most intense,—other electric phenomena, such as bolides or fire-balls, falling-stars, or those more condensed effects of the same cause, the ærolithes formed of atmospheric gases collapsed and fixed in solid masses, which by their density and gravity are driven to the earth, appear effects only of electricity decombining and productive of heat; because they are mostly seen in tropical climates, in summer, and nearer the earth, where heat is

more condensed and more powerful in its action; and because of the atmospheric vortex and pressure the diameter, lessening as it approaches nearer to the nucleus of the earth, makes them in their way to that earth describe a line oblique and diagonal, before they either reach its surface or again evaporate.

Where substances and bodies are originally composed, not only of white light, but of different colours, of those colours the sorts imbodied last and most superficially will by electricity and heat again be driven out first. Thus some substances and bodies, on being ignited, emit a flame first blue, next red and next yellow, before colour being all burnt out, only leaves a flame entirely white; which, when likewise ceasing, reduces what remains of the body to decombine immediately in radiance no longer perceptible to the sight, but only to the feel: and those bodies in which radiant substances calculated to affect the taste and smell have first been incorporated so gradually and imperceptibly as in them to remain quiescent, and for a time not to strike the sense, when suddenly by decombining electricity put in motion and made again from them to emanate, so as to reach the sense in greater quantities, will then again affect this sense with a perception of their exit.

As the radiations of combining electricity and cold, when reaching the sense of feel occasion

in the same a peculiar sensation, so the radiations of decombining electricity and heat, when reaching this sense occasion in the same a peculiar sensation again different from the former, which while in moderation, and benefiting the organs, is agreeable; but when excessive, and injuring those organs, becomes irksome and painful.

And, as from substances by cold combined that cold issues more rapidly into the organs of sense, that cold is by these organs felt more forcibly, so likewise, as from substances by heat decombined that heat issues more rapidly into those organs, that heat is by these organs felt more forcibly. Objects containing a certain quantity both of heat and of cold will to the hand feel cold, when from them that hand, hotter than themselves, extracts more radiations of cold than of heat; and will to the hand on the contrary feel warm, when from them that hand, colder than themselves, extracts more radiations of heat than of cold.

CHAPTER XXVIII.

Effects of gravitation continued.

As we have already seen, earlier centripetal gravitation, from without through time poured into space, and made on all sides from the outskirts of that space to advance inwards to its centre, and from that centre again to recoil or to advance outwards in a centrifugal direction, and to form, by its meeting with further centripetal gravitation from without, the modifications of electricity and of substance; and through the electricity it forms, to consolidate part of that substance, and to impel that part first again in a centripetal, and next in a centrifugal direction, must ever be followed from without by fresh gravitation first centripetal pressing earlier centripetal gravitation forward, and pursuing the same course.

Gravitation must thus continue to this day to exert the same power which it exerted from the beginning of time over all that it first created and ruled; and to this day, if any where of that force of gravitation the usual direction be by any unusual accumulation and resistance reversed—if in any place at which it usually preponderates

in a centripetal direction it is made to acquire a greater force in a centrifugal direction, all the effects usually arising out of its former direction will also be reversed.

The stone before from the heavens dropped on the earth, is then from the earth again made to rise on high; the plant to shoot up its roots into air; the very animal has the course of its fluids so altered, that instead of contributing to the support of its life, they cause its speedy death. A man need only stand on his head for a few minutes to be suffocated.

Now in that spot where, from all sides of the circumference of space, all the later forces, elements and substances within its precincts by gravitation formed, ever continued to be by that gravitation propelled inward in a converging and centripetal direction unto its very centre, in the way most equal and most balanced, they would, from the pressure and influx mixed in this manner most even and balanced, at that centre form and increase a globe, from its earliest and inmost core to its latest and outermost circumference growing, and again by recoil from within outward pouring forth and emanating forces, pressures, elements and substances, diverging and centrifugal, in the mode most even and balanced.

The forces, elements, pressures and substances of gravitation, electricity, cold, heat, light, co-

lours and others of later date, from without pressing upon earlier forces and elements already situated withinside them, would there press upon these in a mode on all sides so direct, even, balanced and free from obliqueness and partiality—from excess, deficiency and disproportion to each other—as there to form and to increase a globe, from its innermost core to its outermost circumference, and from its first commencement to its latest continuation, only presenting, and by every new accession of materials only increasing, one single genus of formations, homogeneous in all their lesser component parts near or distant; and in that single genus one single individual, every where in all its component parts equally connected, equally from within growing in extent, in faculties, in light, in movement, in life, in sensations, in thoughts, in will and in action outward; without any where in any of its attributes experiencing the least deficiency, arrestation, interruption, stationariness, and still less, retrogradation, decrease, death, or dissolution.

These forces, elements and substances would there form a globe, from its innermost core to its outermost circumference, and from its first commencement to its latest continuation, wholly exempt from being, by gravitation and electricity, cold and heat, light and colours and other forces and elements, from without pressing on earlier

ones already within, in a mode oblique, indirect, partial, uneven, unbalanced, disproportionate, and in some portions of time and space too strong or too weak relative to those penetrating into others, in different times and places made to show, here accumulations and stationariness, there attenuation and volatility,—here pressures and there resistances,—so excessive or so inadequate to those shown elsewhere, as to produce genera, and in these genera individuals simultaneous and successive, formed and made to grow separately from and independent of each other; some stopped in their individual growth, extension, and development by that of others, and others by their individual growth and extension and development again interposing between and preventing that of the former; and all liable to have of the materials of further gravitation, electricity, cold, heat, light, colours, life, sensation and thought, the further entrance in, and movement, circulation, and transit through them so stopped, as to be again partially doomed to immobility, obscurity, insensibility, ignorance, error, even injury corporeal and mental, and finally, decay, death and dissolution.

But in proportion as from that globe most primary and most central, we passed more over to other surrounding globes more late and partial, partly only by the forces, elements and substances

again from that first and most central globe issuing outward in a centrifugal direction, and partly by fresh forces and elements directly from without to that central globe converging, till further from the same and nearer to the circumference of space, the two opposite forces met and arrested each other, formed and increased, we would more, by the manner oblique, indirect, uneven, and partial, in which from opposite sides these opposite forces were made in these secondary globes to meet, find them by opposite pressures uneven, oblique and partial forming in one period and place accumulations and condensations, cohesions and consolidations, and in another period and place again forming gaps and lacunæ, diffusions and separations, so disproportionate to each other, as to compose genera, and in these genera individuals in time and space only partial and divided from each other; and many of these individuals again ceasing of gravitation, of electricity, of light and of other elements to receive any further influx, and circulation and transit, even before they attained any faculties of life, and sensation, and thought, and will and voluntary action at all; and all those even that by further development attained such faculties, alike liable to have their extension, by other genera and individuals, from other centres developing in a sense opposite to their development, so inter-

fered with, as soon again to be by this interference subjected to injury, suffering, decay, death and dissolution.

Thus while the earliest and most central globe—the abode of immortality, and of ever increasing perfections, powers, faculties, sensations, thoughts and happiness—exempt from imperfections, from injuries, from sufferings and from death,—would constitute what we call heaven, the later and more partial surrounding globes, necessarily offering different degrees of imperfection, of injury, of suffering and of death, intermixed with and alloying life and happiness, would present the various approximations to, or stages of what we call hell: from whence their tenants look up to that heaven to which their emanations will probably at last return, as to their ultimate prospect and hope.

And as far as we can trust to our faint perceptions of the systems of globes situated beyond our own, and to the more distant parts of our own system, our observations on the same already confirm this theory.

Already, when compared with what our reason tells us to be the condition of the first and most central globe of all—that globe which from the remote corner of the universe occupied by us our sight cannot yet reach, even those stars called fixed—those suns of other systems most immediately after and through the channel of this pri-

mary globe formed,—already, by their progressive movement in space, show that the pressure of gravitation from opposite sides falls upon them in a mode somewhat uneven, oblique and unbalanced; and give the assurance that from their movements, uneven and unbalanced, they must derive other further pressures and influxes equally uneven and unbalanced, causing in their internal constitution a considerable inferiority to the first and most central globe, as well as difference from each other; circumstances which the peculiarity of the colours they shine with and emanate, and the difference of the hues of some from those of others, fully confirm.

In the atmosphere that envelopes our own sun, the gaps and fissures called spots, visible from the earth, and constantly changing in number and in size, show the changes and inequalities constantly going forward in the exhalations rising from within.

But in the planets that surround our sun, the effects of the unevenness, obliquity and partiality of the pressure from opposite sides that first composed and still continue and increase them, seem more evident and more striking. These planets, all again less stationary, less fixed in their places, —more tossed about, more dependent in their movements on the influence of higher bodies—even than our sun itself, again at different distances winding round that sun, are subject to all

the vicissitudes arising from their more complicated movements.

And even among these planets how great must be the difference!

Perhaps in the globes of our system most distant from its centre, of the cold and the heat there from gravitation and from electricity arising, a less quantity made to reach the sun, and a greater proportion immediately diverted to these secondary planets, might leave a dependence on the returns from that sun, for supplies, less urgent than exists in planets formed nearer to that central orb.

But be this as it may, where even nearer that sun the pressure of gravitation from opposite sides on a planet, still of that planet, as it does of Jupiter, left the axis of rotation round its own centre to coincide with the diameter of its orbit round the sun, as long as from that sun itself emanations on all sides issued in equal quantities, they would necessarily in the planet fall on each part of the same zone in equal proportions. Each zone would still, throughout every successive period of the continuation of the planet, have alternate days and nights of equal length—an equal alternate degree of heat and cold. There would in the planet be no alternate vicissitudes of distinct prolonged summer and winter, each separately continuing during a certain series of days and nights. There would not

be days and nights more distinct at the equator, more blended at the poles. Vegetation must in each zone continually go on at the same rate, and with the same rapidity: though even here certain zones receiving from the sun rays of heat more vertically, and others more obliquely, might from these rays receive developments at all times very different.

But where, as on our globe, to other irregularities of situation and movement still is, by a pressure of gravitation from opposite sides uneven and ill-balanced, added the irregularity of a rotation on its own axis oblique to, and acting at an angle with, the diameter of its orbit round the sun, that second irregularity produces in each of the different zones of the planet individually, at different seasons of the year, a difference in the quantities of light and other forces and substances received from the sun, which must again infinitely increase its other irregularities and vicissitudes, in their turn arising out of these same circumstances.

Yet can even the irregularities, the unevenness, the vicissitudes of too great pressure and too great yielding, too much speed and too much torpor, too great condensation and too great diffusion—the distinctness, and partiality and interference of genera and individuals, distinct and different in time and place from each other, and from different centres extending in opposite

directions, and conflicting with, and subduing or subdued by others, and causing in each individual alternate vicissitudes of growth, development, welfare and injury, happiness and misery, advancement and retrogradation, life and death, combination and dissolution, which, on this globe, are every day experienced, only again be trifling compared with those which mark the globes again appearing in the characters of later satellites to planets themselves.

In many of these satellites no combinations perhaps ever reach that degree of development in which to mere sensation of the present is added recollection of the past, or anticipation of the future; or where to mere insentient vitality is added sensation; or even to mere mineral consolidation are added organization and life. The extremes, the vicissitudes of cold and of heat are perhaps, in these satellites, too great yet to produce any life, any sensation whatever. They may yet only present the solid forms of mere metals and stones, mere ice and snow—may, perhaps, only to the forms and substances add the vicissitudes and movements of mere hurricanes and deluges, earthquakes and volcanoes. Such, at least, seems to be the condition of our own moon.

What shall I say to those congregations of substances; those bodies by a gravitation again more uneven, more unbalanced even than that which formed and moved satellites, in their turn com-

posed, which under the name of comets still are compressed, moulded and moved in a manner so irregular, as yet to know no peculiar parent, to pay allegiance to no peculiar ruler; to be attached to no peculiar principal; as, like entities, unavowed by all, and erring unclaimed through space, at one period to be driven to the furthest extremities, and at another to be brought close to the innermost recesses of our system.

Many of these seem not yet in any of their parts to present any of that permanent solidification, cohesion and form, which is the result of mere cold and congelation. If at one time pushed to the utmost outskirts of our system, where, perhaps, cold and condensation preponderate most, they seem to assume the solidity and torpor of ice, at another time, and when again driven to the inmost centre of that system, where the sun reigns with least control, they are made to experience the distention and diffusion of mere vapour, gas and radiance. If any of them may, during the transient periods intervening between their alternate approach to either extreme of their elongated orbit, produce any hasty vegetables or animals, these must at one period have their vitality, by the extremes of cold which torpifies every fluid, again arrested; and at another period have that vitality by the extremes of heat, which again dissolves every solid, annihilated and destroyed.

And in proportion as by their situation these bodies acquire less internal capacity for stability and for repose, they seem, in a greater degree, to possess the unenviable privilege of disturbing the security of other bodies better gifted. The comet of 1680, during its period of density, gave Jupiter a shock and a deflection from its former course, from which even the later rushings in of gravitating force and pressure have never yet permitted it to recover: while the subsequent comet of 1778, in a state of greater diffusion, passed several times across the satellites of the same planet, without causing in their general movements the least derangement perceptible to us; whatever deluges or other injuries of a more partial description it might, imperceptibly to us, have produced at their surface.

Wherever took place, and by whatever circumstance was caused, on this peculiar globe of ours, the pressure of gravitation so uneven as to produce in its motions round its own axis the deviations from its orbit round the sun,—the obliquity, the tilting over, the inclination—which it now presents, this irregularity in its situation, and in its aspect relative to the sun, must account for many of the other irregularities which we at present witness on its surface.

CHAPTER XXIX.

Of substances all alike first radiant, gaseous or liquid, all subsequent combinations and consolidations again later and more complex than those called mere congelations, whether they still only be in bodies merely mineral, inorganic and lifeless, or whether they be in bodies organic and living, vegetable, sensitive or also intellectual, and whether they only be in forms merely cellular, or also in forms vascular, are still produced by remodifications of the same force of combining electricity and of cold, by which already are produced the earliest and simplest crystallizations called mere congelations; and like these simpler consolidations are made to commence in forms merely crystalline.

I BELIEVE electricity productive of combination and cold to have in substances produced not only the sort of combination and consolidation ending in cohering solids called mere congelations or ice, but also every other sort of combination and consolidation into solids more late, partial, complex and cohering, which we know, whether still only called merely mineral, or whether vegetable and animal, vital, sensitive and intellectual; whether only remaining cel-

lular, or whether also in part becoming vascular.

I believe that not on any difference in the force combining, but only on a difference in the substances combined—on the number and the proportions relative to each other of the latter,—depends whether these substances be only combined in solid bodies called mere congelations, or in other different bodies still merely mineral, vegetable or animal, of a later, more partial and more complex description—whether in bodies merely cellular, or also in bodies of a vascular sort:

Because, firstly, like mere congelations by electricity of a combining sort and cold into mere ice, all other consolidations later and more partial into solids more complex and fine, mineral, vegetable and animal, unto the very last and highest into human organs vital, sensitive and cerebral, first from a more external space take their beginning, and only more gradually act upon and penetrate into the substances thus far still fluid, more inward, which they combine; and in these produce their consolidation further inward by such progressive degrees, as still only to have the inside of their mass fluid, after the outside envelope already is consolidated—witness all organs, vegetable and animal not yet solid throughout, but still within their integuments containing saps and fluids:

Because, secondly, in the same way as in the

consolidations by electricity of a combining sort and cold into mere ice, in every other consolidation and crystallization later, more partial and more complex, whether in bodies cohering and solid still merely mineral, or already vegetable, animal, vital, sensitive or intellectual; whether in forms still remaining wholly cellular, or whether in forms already also partly becoming vascular, we still retrace, while the process is going on, the same effects of forces shooting, radiating, resisting, crossing each other, vibrating, oscillating and alternately dilating and contracting, already perceived in mere water, when by combining electricity and cold only still made to congeal into mere ice; or, if we no longer perceive them, do not cease doing so from their internally ceasing to be, but, on the contrary, from their becoming so numerous, so rapid and so minute, that our sense can no longer continue to receive of them a distinct perception:

Because, thirdly, some substances, first still radiant, gaseous or liquid, even more complex in their component elements than mere water, such as certain metals, salts, &c. themselves still evidently are by mere combining electricity productive of cold, from a state of fluidity consolidated into the solid and cohering forms they display;—because in their solid and cohering state they still only remain congelations somewhat more complex, more permanent and more resisting the decombining power of the elec-

tricity causing heat, than do the congelations of mere water into mere common ice; because like them they ultimately are by mere heat again liquefied and dissolved in gas and radiance—witness gold, silver, brass, and iron, all by a certain degree of cold alone still rendered solid, since by a certain degree of heat alone again dissolved:

Because, fourthly, like the mere congelations by electricity of a combining sort and cold of water into ice, all other consolidations later and more partial of substances more varied than mere water, into solid forms, mineral, vegetable and animal more complex than mere ice, while they are going on, still are accompanied by a peculiar influx and absorption, in the substance consolidating, of cold; evidently felt not only in the congelations of water into ice, but in the consolidations of certain minerals of a more complex sort, such as of liquid mercury into a solid mass, and of liquid salts into solid cubes; which again, when dissolving, as evidently let out that cold which in consolidating they evidently took in: because if in certain sorts of consolidations more fine and minute, mineral, vegetable and animal, going forward outside our bodies, we no longer perceive the cold rushing into the substances solidifying, this arises merely from the quantity of cold entering into them, no longer making in the quantity of that drawn out of our frames any perceptible difference; and because in the consolidations and assimilations

after a hearty meal going forward in our own bodies, a sensible chill again pervades these bodies themselves:

Because, fifthly, like the first crystallizations by electricity combining and productive of cold formed under the name of congelations in pure water, when transformed into hailstones, snow-spangles, flakes of ice, and ramifications of rime, all other later consolidation, whether merely mineral, vegetable, or animal, vital, sensitive, or intellectual, merely cellular, or in part also vascular, alike first and fundamentally still show those forms composed of alternate parietes and intervening pores, that cellularity, those alternate facettes and angles, still called crystallizations, always similar in bodies composed of the same sorts of substances, and united in the same sorts of proportions, and always different in bodies composed of molecules of different sorts of substances, or united in different relative proportions, which necessarily arise from the combination by electricity and cold of molecules, already having singly peculiar forms always the same in the same, and different in different substances; before, by further continuation of this same combining force of electricity and cold, of these cells aggregates more extensive are again spread out and made to cohere into collective forms still thin and flat, but more laminar and follicular, themselves again in their turn by later reduplica-

tion of the laminæ made to form solid bodies more thick and dense; which in part again subsequently, by later weights pressing upon the centres of those bodies till they make their sides curl up and their edges rejoin over their more fundamental parts underneath, are more partially converted into the shape of those cylinders or tubes called vessels:—as we perceive in the crystallized strata of mineral bodies, the leaves of vegetables, and the laminæ of animal muscle and membranes, only by degrees from fluids changing to solids, and from solids merely crystalline and cellular, again partly made to become vascular:

Because, sixthly, in all substances consolidated in a form later and more complex than that of mere congelation, from that of the fixed star most distant from us to that of the mite within our grasp, we still find that elasticity—that dilatability and contractility—still to remain evident to the sense of sight, even when it no longer is perceptible to that of feel, in the scintillations of the stars, which already to a certain degree is a characteristic feature of congelations into mere ice; and denotes that the consolidations of these stars, like those of lesser bodies, only proceed from molecules of certain shapes having been, by the force of combining electricity, so approximated as still to remain susceptible of greater alternate contractions and dilatations:

Because, seventhly, all substances, already solid, whether still only aerial or already terrestrial; whether still merely mineral or already vital, sensitive and intellectual; whether still only cellular or already vascular, only appear in external size and in internal vigour—in developement, tone and buoyancy,—to increase faster, in proportion as the electricity productive of combination and cold seems to exist, and embrace, and affect them in quantities more intermixed with that of the electricity productive of decombination and heat; and because peculiar forms and faculties can only be subsequently increased by the very same agents and media, by which they have been first produced:

Because, like the mere congelations into ice, all other consolidations, more late and partial, not only into bodies still inorganic, but even into bodies organic and living, unto the last and highest forms vital, sensitive and intellectual, still remain liable to be by the same power of electricity, of a decombining sort, productive of heat, by which already mere congelations again are decombined, also again decombined, dissolved and made to return to a state of mere radiance.

Because all bodies thus combined, unto the last and highest, in again decombining let out, mixed with electricity of a decombining sort or heat, a great deal of electricity of a combining sort or cold; not to advert to the very unusual

quantities of decombining electricity let out by peculiar animals, such as the electric eel or gymnotis, the torpedo, and the professor Halman of Francfort on Oder; who can at all times let out at pleasure, from certain receptacles, certain explosions of electricity very copious; and because entities can only again let out what they first took in:

Because even where the functions, vital, sensitive and intellectual, are by too much electricity of a decombining, distending and relaxing sort, productive of heat, or by the later effect of such decombining electricity again weakened, reduced, obstructed and impeded; they can, by an artificial supply of electricity of a combining sort productive of cold, again be restored to their former tone, bracing, invigoration and permeability.

Because no line of demarcation can any where be drawn between consolidation effected by mere congelation, and between any of the other sorts of consolidation more fine, more tenacious, and more lasting here named: because the one insensibly passes over into the other; inasmuch as the congelations of plain water into ice, and those of saline fluids into solid salt crystals, and those of metallic fluids, such as mercury, into solid malleable metal, and those of molten iron into a hard and resisting lump, all alike present an insensible transition from mere congelations to

consolidations more complex, and only depend for their permanence in either shape, on the quantity of cold or of heat made to penetrate into them:

And because, finally, if substances more complex than mere water are, by a force of electricity combining and productive of cold less sensible than that which is required to congeal mere water, already reduced to a state of solidity more lasting than that to which is capable of being reduced mere water, this is only owing to the molecules of those substances, more varied and more complex, presenting forms and dimensions which from their variety are enabled to be, by a cement of cold lest forcible, made to experience a degree of cohesion more intense.

So small a quantity of cold suffices to condense and cause cohesion between the molecules, probably very various and complex, which together form the compound called iron, compared with that which is required to produce cohesion in mercury, that even in latitudes on this globe which naturally accumulate most heat, iron still remains congealed in a solid mass; whereas in those latitudes in which accumulate least heat, while many other liquids remain condensed and congealed, mercury already again is rendered fluid; so that while iron is perhaps only constantly found in a fluid state in planets so near the sun as Venus, quicksilver is, perhaps, only

found permanently hard and cohering in planets so distant from the sun as Saturn.

That electricity of a combining sort, productive of cold, can only, when in small degrees, cause molecules of substances, in their nature, form and dimensions more varied than those already combinable in mere congelations, to be combined in the shape of solids, mineral, vegetable and animal more permanent, appears, since water, which singly cannot yet be consolidated in a cohering shape more permanent and more closely knit than that of mere ice, already by the simplest heat again dissolvable, when again mixed with mercury and sulphur, already immediately consolidates into a solid body wholly dry and cohering, no longer by the degree of heat, which again reduces mere common ice into water, fusible; and when added to sulphuric acid and burnt clay, in the very midst of its effervescence, suddenly turns into a solid artificial stone.

And that the smallest quantity of positive cold already suffices to congeal and render cohering certain substances, which the smallest quantity of positive heat again suffices to dissolve, we may see in that potassium, which, when congealed, may even on a sheet of ice again, by the mere penetration of heat from the surrounding atmosphere, be made to kindle up, and with a bright flame to return to a state of radiance.

If, on the one hand, certain substances, like pure water, already capable of being singly, by electricity of a combining sort and cold, consolidated in the crystalline forms of mere congelations and ice, are not yet singly capable of being, by that combining electricity and cold, combined into the crystalline forms more durable, more resisting heat, in which even substances more late and complex, still only mineral, and, above all vegetable and animal, are by the same or even by a less degree of electricity of a combining sort and cold, consolidated:—if water requires the admixture of other substances, in order to be combined into these modes more cohering and tenacious than that of mere congelation, mineral, vegetable and animal; while substances more complex are already capable of being by electricity of a combining sort, when accumulated in great quantities, more hastily combined into mere congelations and ice, as well as when diffused in smaller quantities, more slowly, and leisurely and gradually combined into forms, mineral, vegetable and animal, more complex and tenacious;—this, probably, only arises from these molecules of mere water singly not yet possessing that variety of forms relative to each other, necessary to render a small degree of the pressure of combining electricity able to give them that cohesion more strong, intimate, lasting, and impenetrable to the de-

combining force of heat, which the forms more varied of the molecules composing the latter bodies already suffice to give them; while the more varied forms of the molecules composing the latter bodies, at the same time that they enable these to be, by a degree of electricity and cold less condensed, and perceptible, combined into these forms, mineral, vegetable, and animal more firm and cohering, do not prevent them from being already, by a cold more intense and accumulated, congealable more hastily into mere ice: and what confirms this supposition is, that, in fact, the cold which condenses substances in the way of mere congelation is always very perceptible to our senses, while that which consolidates substances in these latter modes is so diffused as often to become wholly imperceptible to those same senses.

Though molecules of substances can only be made to cohere by having their solid parietes divided by intervening interstices or voids; and thus can only first be combined, in the way of crystallization, it is not essential to their cohering to a certain extent, that these substances, and thus, the form and disposition of their solids and parietes, should, to that full extent, be homogeneous and similar. Substances and crystallizations of one sort may cohere with substances and crystallizations of another different sort; and often, on this globe, the uneven, irregular, and

confused mixtures of substances have produced cohesion of molecules so varied, as to render it impossible any where in a solid mass to detect a peculiar mode of crystallization, or to distinguish it from another again different. But such is the tendency which molecules of different substances, from their peculiar form, receive, to a peculiar mode of crystallization, that as soon as in a fluid aggregate any peculiar species of substances and molecules preponderates, these preponderating substances generally are, by the pressure of electricity, made to extricate themselves from the rest, and to form crystallizations more distinct, protruding from the more mixed mass, which then is called their matrix.

That the light and the colours, which already were the chief component materials of mere water and ice, are still the chief component materials of all substances capable of receiving solidifications more complex and tenacious called mineral, vegetable, or animal, appears, since all mineral bodies, from that fulminating silver which on the least contact with air, and with the oxygen and heat contained and compressed in that air, unravels, inflames, explodes and disperses in gas and radiance, to that iron, which day after day, in the shape of a kitchen-grate, resists the hottest fire, and assists the combustion of the hardest materials, itself unignited and undissolved; and all bodies vegetable and animal, least readily in-

flammable, when heat is presented to them in certain proportions and under certain circumstances which favour its penetration into the same, are thereby made to decombine, ignite, inflame, and dissolve in the form of light and colours: iron itself, when reduced to minute filings, and mixed with sufficient oxygen to begin its dissolution, being by degrees seen to inflame, to burn, and to let out the light and colour contained in it; till the aggregate be entirely consumed and made to return to radiance.

I have already observed that all substances consolidated, whether in the form merely of congelation, or in other forms later and more complex, mineral, vegetable and animal, even when aggregated to the greatest thickness, as long as they retain between their solid molecules,—between their parietes,—pores and interstices sufficiently regular to let through the light falling upon them, and not to bewilder and retain it in their mazes, remain transparent; but that other substances in which this was not the case, only in very thin plates remain transparent, and as soon as conglomerated in thicker bodies, so arrest the light they receive from one side, as instead of letting it through in a straight line to the other side, to refract it at angles, or even to become entirely opaque, and entirely to reflect whatever light and colours they do not retain. The different relations which the forms of the molecules

of substances consolidated bear to the different movements of the colours that fall upon them, determine, of the peculiar colours floating in air, those which they retain, and those which they again reflect. Sulphur, while solid, receives and retains the blue and reflects the yellow rays; whence, on being ignited, it again emits the blue colour. Gold with the blue retains part of the yellow hue; whence, reduced into lamina so thin as to let some light through, it shows a green transparency. Iron is supposed to retain invisibly that red which, emitted with rust, is reflected in carmine, gives to the rose its blush, and colours the blood of the higher animals.

Some substances, like water, and even minerals more complex, are already by cold made to cohere easily enough, already from a certain degree of cold in the very atmosphere to receive that cohesion which we find in hail, in snow, and in atmospheric stones: other substances mineral, vegetable and animal require the resistance and counter pressure of the earlier solid bodies of the earth to serve them as a mould, before they can be brought to a state of distinct, perceptible and permanent form and cohesion.

Some substances, especially of the mineral sort, after being solidified, still are by gravitation centripetal or centrifugal from the atmosphere overhead or from the globe underneath, in their interstices made to receive new fluids

and gases which, from one side poured into, circulate through their mass, till at the opposite side they be again expelled. Sometimes in their way through these prior bodies these fluids detach from them and drive along in their passage part of the solids already embodied; and thus render and leave what substance remains solid, more porous and brittle: of this description is the red or brown rust of iron, and the green oxidation of copper. Frequently these rusts, on issuing from certain substances and bodies, again, with fresh fluids and gases from air combine in new consolidations and substances, again different from the prior nuclei and strata over which they are formed; and thus arise acids, alkalis, salts, sulphurs, earths and other later mineral formations.

Round the nucleus of centrifugal gravitation, which lay the first foundation of this globe; and within the mass of different gases, from substances first radiant round that nucleus congregated, and after the solidification of part of these gases first in the shape of mere congelations—of seas of mere water, and of continents of mere ice, still entirely transparent or merely white, which sketched out its earliest and inmost solid kernel—would first again with these bodies still merely congealed become intermixed other solids yet merely crystalline, inorganic and lifeless, but already, like metals, oxydes, earths, &c.

displaying, with greater cohesion and powers of resistance to the decombining force of heat, all the various hues of the rainbow; and which in time, by their further combinations and decombinations, again become ready to receive and to mould the substances still more varied that fall upon them, into forms still more complex, called organic and living.

Of this supposed progress of solid forms we find the confirmation in the mean density of this globe, calculated altogether as eight times that of mere water:—in the masses of rock salt which must line the bottoms of the most extended seas, and which in many places even protrude from among the later substances of the land; and in those metals of which the greater solid aggregates are every where only found, as we dig deeper into the primeval substructures and foundations of this globe; and of which only the later ramifications are beheld in those veins which ascend to the very surface of our earth.

Of this fancied progress of solid forms—of these successive creations of cohering bodies, beginning from the earliest and innermost kernel of the globe—while the mind suggests the idea, the sense can no longer obtain the evidence. The nature of the innermost kernel of the earth must evermore, while its external envelopes remain sound and intact, remain concealed from those entities that crawl over these latter. After

the many later successive strata of various substances which have oppressed and hidden the earlier strata of the earth from our view, the very deepest expectorations of nature herself, through the channel and orifices of volcanoes, can no longer give samples of their internal composition; and still less can the puny efforts of man penetrate to their main body. These efforts, however great, can as little enable us to advance downward to the most internal solid strata of our globe, as upwards to the most external gaseous envelope of our atmosphere. The greatest depths in the bosom of our earth to which our tools can reach, amount not to the eight thousandth part of our ball's diameter. What lies further inward, hidden from our eye, can only be inferred by our mind. Any revolution in our planet, sufficient to expose its inmost bowels, must first sweep from its surface the last wreck of every entity capable of taking of their construction the least cognizance.

It has lately by some been supposed that all the molecules of substances mineral, vegetable and animal, before they are combined in larger aggregates, individually possess life: that of their faculties of life the exertion and the display are, by their combination in these larger masses, rather trammelled than assisted and increased; because of some substances which appear inert and motionless when seen in large

masses, the molecules, when detached from each other, and reduced to dust, often are found to oscillate rapidly, to wind on their axis, and to perform other movements supposed to arise from internal powers of life.

To me this conclusion seems unfounded. To me it appears that the mere forces of gravitation centripetal and centrifugal, where from opposite sides meeting at such angles as to press unequally on different parts of intervening molecules, are sufficient to produce in these molecules movements similar to the rotations produced in the largest cohering globes; when not rendered abortive by the cohesion of their mass or by other incidental circumstances: at any rate, that we are not warranted to attribute to individual molecules, singly and in their detached state, faculties which only seem to result from their very combination, their circulation, their change.

Among the substances evidently shown to begin in radiance, since already found among the highest and lightest atmospheric gases which by later compression of electricity enter into vapours, clouds, rain, water, snow and ice, but which on the earth are also found pure in greater masses merely mineral and unorganized, before they be found to form a component part of other bodies organized and living, vegetable and animal, is that called silica.

This silica has generally been supposed to have been combined neither out of the substance called light, nor by the pressure of the force called of combining electricity; because the substances in their turn in great measure composed of light, and by forces of combining electricity,—such as flint, spar, glass, rosin and silk—powerfully resist the decombining powers of electricity; and because when at last they yield to these powers, they are generally calcined without perceptible combustion, emission of light, or reduction to a state of radiance.

However, that silica is in part composed of light, and thus, in a solid state, contains light, is proved by a flint, when forcibly struck, emitting light in the shape of sparks; and since flint, when reduced to dust, may by decombining electricity powerfully condensed be dissolved.

So greatly however does silex resist more moderate powers of decombination, that it is considered as an ægis against such; and that, mixed with the other substances which enter in the composition of bodies vegetable and animal, whose component substances remain in constant circulation, it is by the centrifugal pressure from their insides again driven to their surface, and there by centripetal pressure from without stopped, condensed and accumulated in the shape of a pellicle called epidermis, which envelopes them. This pellicle screens these bodies to a certain degree

from the general and forcible inrush of decombining electricity, and of other forces and substances; and only permits these so partially to penetrate athwart the interstices and pores left in this integument, as to permit its continuing to cohere, even when by that influx the parts more internal are again made to separate and to dissolve, —a phenomenon we may frequently witness, since an electric stream from without, sufficient to melt the metal case of a man's watch in his pocket, or to decompose the internal pulp of a pear, or to dissolve the internal muscle of a man's body, though covered by the epidermis, leaves of that epidermis itself the cohesion undisturbed, or only produces in the latter those partial lacerations— like those produced by a sharp instrument— which indicate a partial accumulation of pressure: and since the gastric juice, in which enters much electricity, though it easily decomposes in the stomach vegetable and animal bodies, of which the epidermis has been previously broken, leaves those of which the epidermis has escaped entire from the tooth, however soft and pliant, to pass through the bowels uninjured.

Silica, taken into the composition of bodies vegetable and animal, and from within these bodies again by degrees driven out, till again by later pressure from without at their surface accumulated and made to form a pellicle more dense and close, does on this globe both good and harm.

On this globe, where often, on objects and entities from without first formed and moulded, from without later pressures, penetrations and frictions become so excessive as, instead of only leading to their further combination, again to lead to their later decombination, this silex, by gradually from their different parts internal and external again exuding so as to form round them an additional external integument, envelope and partition, dividing each of the internal organs from the next internal organs of the same individual, and the whole of these organs of that individual from external surrounding space—by only letting pressures and penetrations from without through the pores of these pellicles into the body in moderate quantities, and excluding excessive pressures and influxes—gives the bodies thus enveloped additional means of resisting the excess of that pressure and influx from without. It helps to keep each of those inflowing elements within its proper bounds; prevents any of them from being by sudden shocks or by frictions confounded with other neighbouring ones; and serves them as an ægis—a shield.

On the other hand, on this globe, where already, in consequence of prior imperfections, substances are partially distributed and divided; where they are made to compose many genera, and in these genera, many individuals simultaneous and successive, again distinct from each other, and them-

selves again become the cause of other later imperfections, these integuments still increase this distinctness, this separate individuality; and often, by becoming obstructed and clogged, prevent even of elements from without that more moderate influx in the body, necessary to keep up from one side its circulations, its assimilations, its nutriment, and the other attributes of life and growth, which again are calculated on the other side, by supplying its losses and deperditions, to prevent or to defer its decay, death and dissolution.

CHAPTER XXX.

As gravitation centripetal, electricity combining, and cold, of substances first radiant produce the later congregations, combinations, and consolidations, not only in the form of congelations, but in all other forms more late, partial and complex, unto the last and highest of an intellectual sort—those of the cerebral system of man; so gravitation centrifugal, electricity of a decombining sort and heat, of substances reduced to any sort of consolidation, from the first and simplest into mere congelations and ice, unto the last and highest into organs vital, sensitive and intellectual, also alone again causes the later re-dissolution, even through the medium of putrescence, into forms of a simpler sort solid and fluid, unto that of mere radiance.

We have seen that of substances first radiant, all later combinations from that state of mere radiance into a state of greater solidity, cohesion and combination, effected not only in the mode of mere congelation, but in every mode later and more partial, mineral, vegetable and animal, unto that in the shape of the highest organs of

the human brain, was effected more proximately or more remotely by the same electricity productive of cold and combination, by which the combination of these substances, in the mode of mere congelation, was already produced; and was thus still only a somewhat more distant offspring of the mere force of gravitation, from which both the substances by combining electricity and cold combined, and the electricity and cold combining them, already themselves arose.

We shall now see that, in the same way, of all substances, from a state of radiance reduced to a state of greater combination, solidity and cohesion, whether only yet that called of congelation, or whether any other sort more late and complex, mineral, vegetable or animal, merely vital, sensitive, or also intellectual, all later decombination again, whether more partial or more entire—whether still only produced by partial pressure or bruising, which still leaves many molecules to cohere together, or by more general melting, which again separates each individual molecule from the rest; whether by putridity, fermentation, effervescence, slow combustion, rapid explosion, or still more rapid detonation, by which even the still solid molecules of gas again return to mere radiance, proceeds either from that same force of decombining electricity and heat, from which already proceed the earliest modes of decombination, called melting, thaw,

conflagration, explosion and detonation, and thus again proceeds more distantly and mediately from that power of decombining gravitation, from which electricity of a decombining sort itself, in its turn, more immediately proceeds; or themselves even from that decombining gravitation more directly and immediately proceed.

That, where from more distant opposite points in space, forces of gravitation, of electricity or others, or the substances by such forces formed, aggregated and moved, have been driven to each other by a pressure and propulsion no longer on both sides so even and balanced that, when in contact, the force or substance from each side advancing equally resists the pressure and progress of the force or substance from the other side advancing, so as to render and be rendered by that other stationary, quiet and cohering with it in a single aggregate and mass, but, on the contrary, by a pressure and propulsion so uneven and unbalanced, that, where in contact, the one preponderating divides the other, and breaks athwart that other, or forces that other to retrograde, while itself continues unimpeded to advance, the mode of decombination thence resulting proceeds directly from peculiar modifications of the force of gravitation, is a thing too plain to need any proof.

That when bodies solid and cohering, organic or inorganic, are thus, whether by tearing,

breaking or bruising—dissevered in lesser parts or fragments;—whether these fragments still remain large and few, or whether they become so numerous and small as only to assume the shape of an impalpable powder,—while the distinct particles still preserve in their component molecules a sufficient cohesion to give a feel of dryness, this decombination is still produced more immediately by gravitation pressing on certain parts of this mass more than on others, no one can doubt.

Nor can any one doubt that even, when of bodies solid and cohering, organic or inorganic, more late, more complex and more tenacious than mere common ice, but still fusible, the decombination is so much more general than that just described, as to render the molecules of substances all again distinct and separate from each other, and again from dry to make them, by the process of dissolution and melting, become liquid, this decombination, evidently more proximately the effect of that same power of decombining electricity and of heat, from which already arises the decombination of ice, and snow, and other congelations into mere water, is thus more remotely and mediately also again the effect of that earlier and more general power of gravitation, which is the parent of all electricity, both combining and decombining.

This then being thus far self-evident, I have

only to prove that all other species of decombination, by what is called putrescence, fermentation, effervescence, slow combustion, or more rapid explosion or detonation; or in any other way more general and entire, that can, in solids which have possessed organization and life, or even in solids of a mere mineral sort more complex and cohering than mere congelations, take place, is still only an effect of the same power of decombining electricity and heat, from which already the decombinations of former combinations in the shape of mere congelation arise.

That all these decombinations of solids more complex, organic or only inorganic, likewise only arise from the distending powers of mere decombining electricity and heat, I believe, because, firstly, all the substances, by electricity of a combining sort and cold combined, not only in the mode simpler and less tenacious of congelation, but in every other later mode of combination more tenacious, mineral, vegetable and animal, can again have their combination by mere electricity of a decombining sort, productive of heat, when carried to a certain degree of intensity, stopped in its career, counteracted, and again in the mode of putrescence, or fermentation, or effervescence, or melting, or combustion, or explosion, or detonation, unravelled and *decombined*, in a manner more gradual or more rapid, more partial or more general: as we see, when the mere influx

of decombining electricity in the shape of lightning causes milk, wine and beer to ferment and turn sour—prevents blood from coagulating; and makes meat corrupt and dissolve: and because, secondly, when in substances solid and cohering, even of an organized description as well as of an inorganic sort, the dissolution in the shape of putridity, or fermentation, or effervescence becomes sufficiently advanced to cause the elements combined again to separate, to be driven out, and to return to a state of volatility and radiance, it causes the emission not only of the light, but also of the heat and decombining electricity, before poured into them; as we know in hay which, when got up in a damp state, is by the heat and decombining electricity that penetrated in it, so made to putrefy and to dissolve, as at last not only to ignite, to burst out into flame, but during combustion, to have that heat and electricity before taken into it again driven out: and see in all other substances, in which putrefaction, fermentation, effervescence and combustion is always accompanied by a considerable emission, not only of light, but of the electricity and heat, which expel that light before them.

And if, while that electricity of a decombining sort, and productive of heat, can only decombine bodies inorganic and lifeless, in the way of effervescence, or ignition, or explosion, or

detonation, unaccompanied by fermentation or putrescence, and can only decombine bodies organic and living alone in the way more slow and gradual of fermentation and putrescence in which it cannot decombine simpler inorganic combinations, this only arises from bodies of an organized sort alone being previously composed of molecules of substances so varied that, when attacked by electricity of decombining sort, they are liable to that decombination more slow and gradual which is called putrescence.

Nay, if moreover electricity of a decombining sort, when it decombines those bodies called organic in the slow and gradual mode of putrescence and fermentation, causes them to emit a taste and a smell nauseous and fetid, this only arises from the same particles which, while from these bodies, in a healthy state exhaling in proportions so moderate as only to benefit the organs of taste and smell, when from these same bodies in a decaying state they exhale in proportions different from the former, and excessive, on the contrary injure and decompose those organs.

Naturally in a body, or aggregate of substances, electricity of a combining sort and cold prevent electricity of a combining sort and heat, from penetrating and gaining ground; and as long as the former electricity prevails, it will obstruct the progress, and arrest the effects of the latter: as we see in all bodies liable to putrefaction, which, while

they remain congealed, remain exempt from putridity.

Nay, those very substances which from others again extract that humidity that to them attracts and in them accumulates electricity of a decombining sort, and thereby renders them dry, and capable, instead of confining and accumulating that electricity, of passing it through them unrested and unconfined, prove the most powerful antiseptics, and preventives of putrescence.

Even of bodies composed partly of cohering solids and partly of intervening fluids, a heat so strong as to make the liquid part of their substance again turn to vapour, and disengage itself entirely from the solid part, before either have time to ferment, will, instead of hastening the more entire dissolution, stop and prevent this latter: as we see in grass when left to turn to hay, and in animal bodies when transformed to mummies.

Bodies solid and cohering may, according to the different nature of their composition, be made to return to a state of gas and radiance, in a way more gradual as well as more sudden; in a way more partial as well as more entire.

The slowest way, and that in which only bodies organized and living can return to a state of decombination, is that called of putrefaction: the next and somewhat less gradual way in which only solid bodies composed of particles strongly

cohering may be made to decombine, is by slow combustion; the next way in which solid bodies less firmly cohering may be made more rapidly to decombine is by explosion; and the last way in which bodies or aggregates still only gaseous can more rapidly be decombined is that by detonation.

Bodies solid, cohering and dry may only be partially decombined and separated in a greater number of lesser bodies, each still solid, cohering and dry, and each still composed of molecules still fixed in their situation relative to their neighbours, by the more summary but incomplete processes of tearing, cutting, breaking or bruising them.

They may be decombined so much more generally in their component molecules separately, as to make them entirely lose their fixity and cohesion with regard to their neighbours, and as from being dry to collapse in a liquid mass, in which the pressure of gravitation shall take a greater hold of each molecule separately, in the way of dissolution, melting and thaw.

When bodies solid or liquid are so decombined that their component molecules are again driven to a great distance from each other, they are said to evaporate, or to return to a state of vapour and gas.

Finally, when the molecules of substance, thus far still by electricity of a combining sort kept

separate and divided, are by the entire removal of that force pressing upon and dividing them into distinct molecules, again left to run together, and to diffuse themselves on all sides in the most unconstrained manner, they return to a state of radiance.

When of substances partly still solidified and cohering, or entirely liquid, some of the component molecules, by their peculiar form, more homogeneous, giving combining electricity more hold upon them than those others do, are made to combine more closely, and in doing so to separate from them and to expel those others more heterogeneous, they are said to ferment; and in consequence of this fermentation the substances more homogeneous that remain become more clear and transparent.

When of liquids, while some of the component substances retain their density, their weight and their collapsion, others are made to return to a state of gas, and to escape in air, the liquids are said to effervesce; and their more volatile parts thus disengaging themselves from the others, and making their escape, leave those others to become more quiescent and more flat.

It however seems that substances more compounded, after they have been made by fermentation to throw off certain of their component elements, less firmly cohering with each other than those that remain, again become, in their more

homogeneous state, capable of absorbing from the atmosphere new substances, which cause in them a new sort of fermentation; since many compounds, not content with showing a single sort of fermentation, after this has ceased, by degrees show in succession different other later sorts, such as the saccharine, the venous and the acetous, each separated from the former by such intervals of apparent quiescence as indicate that in each substance the period during which it throws off certain elements perceptibly, is followed by a period during which it again from the atmosphere takes in other new elements imperceptibly, before it is again ready for a fresh and later sort of fermentation.

Those substances—and they are the greatest number—that in their combined state had imbodied in them a certain quantity of light and colours, when made again to decombine into mere radiance, again let out that light and those colours.

Nay, from certain substances and bodies mineral, vegetable and animal, in which, after being solidified, later light and colour are still by new pressure from without very slight made to enter and to penetrate very loosely, this light and these colours will again, by removal of that pressure from without, be suffered to exhale, without these substances being suffered to decombine more deeply, and to lose the more essential and fundamental of their component elements; as we

see in those stones, plants and insects which, in the dark throwing out light, are what is called phosphorescent.

Bodies and substances by putrescence or by fermentation made to decombine more deeply but more gradually, let out the light imbodied in them less quickly and less perceptibly: those again, by combustion, by explosion, or by detonation decombining more rapidly in less time, emit a greater quantity; and as bodies in decombining let out their substances with less or more rapidity, they produce, as I have already observed, in surrounding gas, during a longer or a shorter period, with less or more violence, those vibrations which in their turn cause in our ears the impressions of sound.

Of some solid bodies the molecules, though made to cohere by a force of combining electricity greater than that which occasions the cohesion of water into ice, are yet made to cohere by a force of combining electricity so weak that their aggregates still, like those of crystal and of glass, have little flexibility; and are by the least excess of partial pressure, tending to throw any of their component molecules out of the peculiar position relative to their neighbours in which they were made to cohere with these, again so detached from these as entirely to lose their cohesion with them, and to snap asunder. Other solid bodies, even of

mineral formation, such as gold, silver, asbestos, and most vegetable and animal productions—flax, hemp, cotton, silk, wool, and hair—composed of molecules more fine, and varied, and admitting in various directions of an approximation of interweaving electricity of a combining sort and of cold, so much more close, dense and intricate as to have its partial pressure much more easily shifted in its situation without being destroyed—still in their thinnest laminæ, with the utmost pliability preserve the utmost cohesion. The utmost bending does not destroy their cohesion and allow their being broken. When flax, cotton, silk, wool or hair only at first sight appear by heat more easily decombined than mere congelations in ice or in mineral solids, this can only arise from the excessive tenuity of their largest aggregates, compared with those in which are seen the former bodies. A hair as thick as an ordinary piece of ice or crystal could only be torn asunder by a force fifty times greater than that which suffices to divide in twain the latter; or could only be decombined by a heat much more intense: breathing upon a snow-spangle suffices to melt it.

Though I have shown cold to be the first cause of combination, yet cold, when so intense as greatly to hasten combination, and to cause substances to condense very rapidly in the simplest and earliest mode of cohesion,—that by mere con-

gelation,—thereby prevents other modes of combination later, slower, and higher even in forms merely mineral, and especially, in forms vegetable and animal, which when heat is more mixed with cold, and retards its effects, and leaves these to be brought about more leisurely, take place. Thence it is that, while in very cold climates, nothing is seen but ice and snow, in hot climates, when these climates supply sufficient fluids and liquids for combination, vegetables and animals show a much greater degree of luxuriance.

We have thus in gravitation, as it is centripetal or centrifugal, seen the first principle of all aggregation and combination, from the first in the largest bodies to the latest in the minutest particles; as well as of all later separation and decombination from the last and highest and most long-winded to the first, most simple and most general. We have in electricity, the later and more partial offspring of gravitation, as it is of that sort called cold, seen the instrument of combination more partial and more forcible; and as it again is of that sort called heat, seen the instrument of decombination more late and more evident: but we have not yet seen in detail how mere combining electricity and cold could cause substances, first only combined in solids inorganic and lifeless, to become by degrees recombined in solids organic and living, vegetable and animal.

People in general, not yet seeing by what secondary media, already existing in inorganic matter, this could be effected, have denied that it could at all by any such be done: have supposed that the first cause, after creating that inorganic matter, stood in need of a second and separate condition or process in order to infuse in part of the former the principles of life. I shall show that, according to my opinion, this mode of proceeding, generally credited, which makes the author of the perceptible universe do piecemeal, by fits and starts, and in a disconnected way, what he might in his omnipotence have done by a single act of his will and power, is wronging his attributes and his works. I shall, I hope, prove that in the very conditions of lifeless matter itself—nay in those of mere time and space—in the very first act of the creation, already were laid the seeds of its last and highest developments, not only vital, but sensitive and intellectual: and that it was impossible that when the former arose, the latter should not, in their turn, have out of them arisen.

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AN

ESSAY

ON

THE ORIGIN AND PROSPECTS

OF

MAN.

BY THOMAS HOPE.

IN THREE VOLUMES.

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ESSAY

ON THE

ORIGIN AND PROSPECTS OF MAN.

CHAPTER I.

Introduction to the modifications which of matter, first only inorganic and lifeless, render a part organic and living.

Many circumstances directly mentioned or implied in the Mosaic account of the creation, which at first sight seem to contradict the evidence of our senses, and to startle the conclusions of our reason, on more severe scrutiny seem perfectly conformable to the real course of nature, and to argue in their early author an acquaintance with that course—with the real data of physics and of metaphysics—more sound and deep than to this day the vulgar herd of men possesses.

Such is the circumstance implied in the words of Genesis, that light existed prior to the luminaries which are generally regarded as its first source: that the fixed stars and our sun were

not the first dispensers of that light, but were themselves only among the later and more condensed aggregates and offspring of that light; first from earlier and more generally diffused sources in these bodies collected and rendered more perceptible to the sight, and, through the medium of these prior bodies, from them again to other heavenly bodies later and less capacious than themselves, transmitted—a thing which I hope already to have demonstrated.

Such again is the doctrine of the human species having first been formed out of the dust of the earth: if by that expression, "dust of the earth," we understand the elements before inorganic and lifeless, out of the combination of which other bodies organic and living were in their turn again composed.

Such again is the doctrine of man having first been in a state of innocence: that is to say, in a state in which, like the brute, he knew not yet the difference between good and evil,—in which whatever he desired, seemed to him good; before he began to acquire an insight in the more remote opposite tendencies of different actions, and to become aware that some actions beneficial to himself might not be so to others; and that some actions, at the moment grateful to himself, might not remain so even to himself, at a more distant period.

There are other circumstances, however, less

conformable than these to the regular course of nature, which we still are wont to assume as facts, because we consider them at first sight to be asserted as such in Genesis; but which I do not think that a more exact scrutiny of its expressions, when taken in all their relations and bearings, exactly confirm.

Such is the doctrine of the Adam and Eve of which Genesis more peculiarly gives the history, having literally been the first created of human beings, and the only individuals from which descend all the varieties of the human race that at present exist on the globe.

Genesis itself, when different expressions in it, detached from each other, are approximated, seems to me to imply the reverse; since in contradistinction to the race of Adam, which the Bible expressly calls the sons—or favourites—of God, it mentions other different races, as the children of men; and states that among them Adam's first born, Cain, after having slain Abel, his second born, fled, and intermarried, and built cities, long before his own offspring could have wanted any; not to advert to a race of giants which Genesis mentions soon after.

Among the beliefs only founded on certain expressions in Genesis, misconstrued or misunderstood, and, as applied in their literal sense, contrary to the course of nature, seems to me to be that of the whole work of the creation having

been achieved in six days, like those days of which, in the more central regions of the globe, seven complete what we call a week; and that of the seventh day having by the Author of that creation himself been devoted to a period of rest from his labours, like that repose which man seeks in order to recruit himself after his toil.

In the first place, the Hebrew word, translated in modern language by that of day, only means an indefinite period; and therefore cannot be accurately rendered by that of day, which signifies a definite period; and should in this instance be the less understood as having a meaning synonymous with that of day, since, firstly, the earlier works of the creation, achieved in certain of those periods, were said to be achieved prior to the period when time could, by the creation of the sun, be divided in what we call days and nights; secondly, in different parts of the globe the sun itself causes the length of single days to vary from a few hours to half a year; and, thirdly, the things said to have taken place during the period designed by the term day, are described as having occurred during the interval between the evening and the morning, which we call not day but night: not to add that the work of the creation, so far from having, after going on uninterruptedly for six days, been suspended on the seventh, that work has not yet, as far as we know, from its first commencement to

this day been suspended for a single instant; that the very act of adding to former periods of time, to former days, a new period of time, a new day, whether of labour or rest, implies a new act of the creation, and a new act of the creation teeming with as many other new acts of that creation, included in it, as there are new objects of nature produced in that single one; that that day which to man may be a day of comparative rest from the voluntary labours of the mind and of the body, must remain to God, who still continues to support that mind and body, as well as all else, a day of labour; that to God—if to him the creation, the upholding, the ruling of the things perceptible to man, be a labour—while nature goes on, while things perceptible have their course, while day continues, while the formation of entities proceeds, while the emanation of fresh time ceases not, there can be no rest from his labours, in the human sense of the word; that only when the advancement of the universe is entirely stopped, when nature herself stands still, and when time ceases to flow, God can be said to rest, in the sense in which the word rest is understood by man; and finally, that the very want—the very need—of such rest from his voluntary labours of body and mind as man can enjoy is a proof in that man of a weakness, unknown even to the more primary productions of God, and wholly inadmissible in God himself.

Among the beliefs, perhaps, not strictly deduced even from the words of Scripture, and certainly not founded on what we see in nature, is that of evil and death only having on this globe begun to prevail at a period subsequent to that of the existence of man; whereas the very first creation and movements of this inanimate globe, themselves already, as we have seen, only arisen out of prior irregularities that were permitted to creep in the conduct of earlier and higher parts of the universe, prior to the creation of our earth,—and themselves the more mediate causes of the creation of this earth,—must already, in the further development of this globe itself, and of the entities inorganic and organic vegetable and animal formed upon it, have necessitated the appearance of evil, decombination and death, prior to the very arising of man, and still more, to the period of any sin in man.

Among the ideas, from certain words in Scripture, or rather, from its silence to the contrary, very generally entertained, is the opinion that of a single restricted inland spot, supposed to have been situated in that part of the Asiatic continent since called Iran or Persia, and, like the later pleasure gardens by Xenophon seen and described in the same regions, named Paradise, having brought forth the first parents of all the living species which have since been dispersed over the land and the waters, throughout all the

different other regions and climates of the globe—those species only able to live in the most extended seas, as well as those other species only capable of thriving in the dryest inland deserts: those since only fitted to exist nearest to the frozen poles, as well as those also only fitted to find their food where the sun has most power: those now only able to thrive on the destruction of other living entities, as well as those now harmless and inoffensive; and those whose first origin can now only be found in the prior decombination and dissolution of other prior sorts, as well as those now requiring for their appearance no such disgusting preliminaries: nay, the opinion of this single spot having brought forth the first specimens of all these future races from their first birth full grown and possessed of all their last and highest forms and faculties;—the vegetables expanded, and covered with leaves, flowers and fruit; and the animals fraught with immediate powers of locomotion, of feeding and of digestion: even the human beings themselves, as soon as they arose, endowed with powers not only of immediate sensation, thought, will and action, but even of reasoning, and of expressing their ideas in articulate and conventional language. It has consequently been thought that from the very first in the garden of Eden was seen to arise alike the hot spice of Sumatra, and the red fungus that only rises amidst eternal snows; the

zoophyte and the oyster, only capable now of living chained to the rock in the abysses of the deep, as well as the eagle and the kite capable of darting across the widest regions of the sky; the whale of the ocean, as well as the camel of the desert; the elephant of the torrid zone, as well as the white bear of the icy pole; the insect that, now only permitted to live a single day, now dies the evening of that period of which the morn saw it arise, as well as the beast which for centuries drags on its useless life: the animalcule which, having no organs of generation, now can only arise out of inorganic matter, and cannot transmit its life to later individuals of its race, as well as the animal which, in a single day, can bring forth numbers of successive generations; the entities of the vegetable and the animal sort that can only, like moulds and mildews, the dry rot and the tenia, at present arise in the bowels or out of the corruption of other prior vegetables or animals—even those that can at present only spring forth from the decombination and decay of prior artificial compounds,—as well as those which can start up directly from the very freshness and fragrance of nature. It has been supposed that what first arose in this abrupt manner, at first was so modified as never to experience injury, decay or death: that, consequently, at first no leaf, no flower, no fruit, could be torn from the tree, be bruised by the

tooth of an animal, be consigned to natural corruption; no animal be supported at the expense of a vegetable or of another animal; no lion or tiger feel inclined to injure a lamb; no horse or cow be suffered to nibble the grass; no entity to live upon any thing but inorganic and lifeless matter; supposing it even required the decombination of some such for its subsistence.

This state of things, however, which, while it lasted, and while it was destined to last for ever, left useless all the forms and faculties of entities organised and living, vegetable and animal, which have since come into play—if these entities in that state already possessed them—or which if while in that state they did not yet possess them, must in that state have still left them in reality wholly different from the entities that since arose, and still exist under the same denomination, however much we may still give it to the latter, could never on this globe have existed for a single instant, according to the present course of nature.

It is wholly out of that course that of organised and living entities, all at first brought forth in a single restricted spot and climate—of the most immovable and stationary plant, as well as of the animal most active and most nimble; of the entity most deprived of loco-motive powers, as well as of the entity possessing these powers in the highest degree; of the being most delicate as well as most robust—of the moss, or zoophyte,

or oyster, as well as of the eagle and the hawk, either the full grown specimens or the first formed germs, after having during a period in paradise found a situation, a climate, a mode of existence suited to them, should each, across intervening elements most different from those it found in paradise, and thus most hostile to its support during the passage, be transferred to some other region, again different from both the former, in such a way as to become, not only during its progress so fitted for the journey, but at the conclusion of its travels so adapted to the new region in which it was doomed for evermore to settle, as thenceforth to leave no part of the globe, first wholly desert, and deprived of any of the races vegetable or animal which it was fitted to support; and which in their turn, now fitted only to live in that peculiar latitude to which they were transplanted, were now equally doomed to perish in those very regions in which they first arose. It is out of nature that the animal first only able in paradise to live on lifeless substances should by degrees only become able to subsist on prior living entities,—should become herbiverous, frugiverous or carnivorous; that the being first only formed for an inland situation, should be able to launch forth in the wide sea. To what use would first have served in turbot his fins; in the tiger his fangs: or when would first in them these supplements have arisen?

Besides these beliefs in things contrary to the course of nature, which probably only arose from our not understanding all the words of scripture in the sense in which they were meant—from confounding peculiar circumstances with generalities, and such like,—there are other accounts in scripture which in their literal sense seem so evidently averse to the present course of nature, that they can only be reconciled with this latter by being taken in a figurative sense: such is the account of the mother of mankind having fallen into evil and sin, not as the natural consequence of that state of innocence itself, in which nothing that tempts our desires by the more proximate gratification it promises, is suspected of having more distant evil tendencies, but by the direct instigations of an entity, for that sole purpose, by powers proceeding in the first instance from God himself, endowed with faculties of mind and body, which that entity does not naturally possess.

Nor can it be denied that, finally, scripture contains certain points which seem not only above our comprehension—a circumstance in our state of ignorance very natural—but even directly hostile to every suggestion which our reason represents to us as comprehensible.

How then are we, when between what our reason teaches us to be the course of nature and what the Bible relates as having existed, we find

this opposition, this discrepancy, to act? which of the two are we to believe, to doubt or to disbelieve?

To this I answer, that considering Genesis was not intended and written as an elaborate and scientific treatise on the origin and development of matter, addressed only to and calculated for the capacities of a select few, who might be more familiar than the vulgar with the abstract terms of science, but as a system of moral duties and religious rites intended to meet the understandings and to rule the conduct of a nation at large; and in which the part relating to natural history and to the origin of things only serves as an introduction, like those which the early legislators of all ancient nations—those only falsely pretending to inspiration as well as those really inspired, were accustomed to usher in their works, for the purpose of investing them with greater authority, and obtaining for them a greater credence:—

Considering Genesis was written for a nation, from its sensuality, its ignorance and its want of capacity, so unable to be in its conduct actuated by motives of a distant, an indefinite and an abstract sort, that, though the chief object of its author be to inculcate moral precepts, he regards the nation so little prepared to adopt these from most potent inducements, that the highest—

those of a life hereafter—are not even mentioned in the Old Testament:—

Considering that among that nation, from its ignorance and poverty of abstract terms, symbolical and figurative language was still so prevalent, not yet as a means only of ornament but as a matter of necessity, that the author of Genesis, after having made the immateriality of God, his exemption from all the attributes and imperfections of matter, and the impossibility of representing his essence by material and sensible means, the chief and leading point of his precepts and doctrine, is still himself continually, by the force of habit, betrayed into representing that God is endued with human limbs and features, and swayed by human feelings and passions:—

Considering that the points most important to our guidance and welfare—those which the Bible was most directly or principally intended to inculcate—such as that of the unity of God, the immortality of man, and the importance to the happiness of that man here and hereafter, of his living in love and charity with his fellow creatures, all are points which stand equally whether we take certain adventitious narrations in a literal or in a figurative sense—as fact or as fiction:—

Considering that in the original text of the Bible there are many passages so contradictory to each other as to render it absolutely impos-

sible to adopt them alike in a literal sense, and that we can only adopt some in a literal sense, by adopting others in a figurative sense, or by rejecting them altogether:—

And considering, finally, that the very idea of being bound to take the whole of scripture—the parts of no practical tendency as well as those of the greatest practical consequence—alike in a literal sense, may startle certain minds weak, but tenacious of their opinion, to such a degree as, in their dilemma and despair of reconciling their belief and their reason, to tempt them to reject the very precepts of scripture most important to their future happiness, both here and hereafter, I think it best and wisest to confine our implicit faith only to the articles which, influencing our actions, must through these actions influence our eternal felicity: where the silence of scripture alone, or an exaggerated stress laid on certain of its expressions in preference to others, would lead us to infer things contrary to the course of nature, not to suffer ourselves to be, by any excessive love of the marvellous, where there is so much reasonably to marvel at, induced to take in a mystic and preternatural sense, what, with some exertion of the reasoning faculties, may be taken in a natural and rational sense: where the words of scripture, even in their most limited natural sense itself, imply any thing contrary to the course of nature, there to

understand them by preference in that allegorical sense, in which it was ever the practice of the East to convey lessons and to inculcate truths; and where between the two different senses given to the same words,—the natural and the figurative sense,—we are no longer permitted to retain the option; where we can only adopt the words, relating facts contrary to the course of nature, as they stand, or reject them altogether; where ultimately there remains no medium, no evasion, no subterfuge, no rational explanation in words of one language ill rendered in those of another—in an allegorical or hyperbolic sense—where we come to a positive conflict and contradiction between nature and the Bible:—where we must either, accepting certain words in scripture literally and as they stand, reject the universal testimony of nature, or vice versâ: where thus we have only the option to believe what repugns to our intellect, or what seems in every respect to glide most easily into the same, and to be most consistent with analogy, then, in respect at least of such doctrines as cannot influence our deeds, our practice, our actions, to do what in fact we cannot—strive as we may—help doing: only believing what we can, and in so doing console ourselves, for what more we cannot believe, and keep our conscience quiet and absolved from guilt, by the idea that a tradition only received on a secluded mountain by a single

man, who durst not raise his eye to its author, and who transmitted that tradition in an artificial and conventional language of man's own making, and from whom moreover it has only circuitously, through multitudes of intervening centuries, and millions of intervening men, with all the liability to mistakes, errors, interpolations, prejudice and pious fraud, to which all human productions ever remain liable, descended to us, must after all be less authentic, and seem less certainly to contain the genuine will of the author of nature, as to what we are to believe of his acts and intentions, than the language of nature itself, to this day from the author of nature coming to us as pure, as unadulterated, as directly, and as free from corruption, as it did the first day it was promulgated.

By such a method, only founded on the sincerest love of truth, I shall guide my credence, at least in those matters in which that credence can have no direct influence over my actions, as is the case with that respecting certain points of natural history touched upon as well in as out of scripture: of the former of which I shall just mention a few more which I think unfounded, before I pass over to what I believe the real truth.

Some people maintain that in paradise there could only have been placed entities living and sentient which from their very first commencement were full grown, matured, and in pos-

session of their last and highest faculties; because, if without parents to rear, to feed and to protect them, they had in that paradise been first produced and placed in a condition more incipient and less matured, such as that in which in the womb of their earlier parents first begin the later offspring of such entities, they could have found neither support for themselves, nor protection against their natural enemies. A mighty fine reason indeed!

Who that reflects does not perceive, firstly, that where the elements, substances and materials, necessary spontaneously to form the first rudiments of entities living and organized, have been supplied and scattered about in quantities sufficient to be able, without the assistance and medium of prior parents of the same sort, to form these first rudiments of actually existing entities, these elements might also have continued to lie about and to be supplied in quantities sufficient to continue being by these first entities involuntarily absorbed, till these entities were by them carried on to that age, maturity and vigour, at which they became enabled to seek their further supply voluntarily, in sufficient quantities if nowhere else, at least in the very bowels of other different entities, organized and living, composed sooner of the same elements and substances with themselves; and secondly, that where, as must have been the case while, from the abundance

of elements of entities living and organized thus far unappropriated, the first of these entities spontaneously arising must in different places first simultaneously have arisen in very great numbers, if some at last became by others destroyed and decombined, others, that destroyed and decombined these first, would thereby at least themselves continue to live, and to be supported sufficiently, by degrees to become able themselves to perpetuate their race: nay, that if by some accident—some revolution of nature—the whole of any or of every living species again became destroyed and decombined, as long as its elements remained or were reproduced, the same causes that first had occasioned these to be spontaneously combined into actual organized and living entities, would make them afresh in due time recombine into such?

Not only men ignorant and short-sighted believe that the first parents of all species organized and living, vegetable and animal, have arisen at least in part out of a principle different from and independent of any principle found in mere lifeless and inorganic matter; but even men of investigation and science frequently consider entities organized and living to have derived their organization and life from a principle totally different from any principle that could have proceeded from their lifeless substances and forms: they believe that an intransgressible line of sepa-

ration divides all entities, or at least all the parts of such entities that are inorganic and lifeless, from those that are organic and living: because they entertain concerning life and organization a number of other errors of which this latter opinion is the direct consequence:—

Because on the one hand they believe that all bodies inorganic and lifeless, unto the last and highest, in all their component parts by mere agglomeration directly from without, not only are first formed but to the last continue to be increased; that none of these, by elements, first from opposite sides without made to penetrate more inwardly, and there to meet, consolidate and cohere, first formed, are afterwards, by other elements from without, following these first inward, are next, on meeting, from within again made to recoil and to circulate more outwardly, before they are first permitted, round the former ones, to consolidate and to cohere; and are thus, from a lesser nucleus within, made gradually to increase and grow more outwardly; that these aggregates still inorganic consequently in them offer no lasting succulence, no growth of a gradual sort from within at all, no power of driving substances outward, nor no faculty of replacing these substances driven outward by new ones coming in from without, no renovation whatever; that what began in lifelessness and want of organization cannot in time and by degrees

pass over into a state of organization and life; that entities first inorganic and lifeless, while they last and grow, to whatever dimensions they extend, must still ever from first to last remain wholly separated from and unconnected with entities organic and living; whereas on the other hand they believe that all entities organic and living, from their earliest beginnings all equally distinct and separate from all inorganic and lifeless aggregates, and from the first have that succulence, that circulation from within, that gradual growth outward, that replacement of substances driven outward by other substances from without coming in, that renovation of substances and parts, which substances and bodies first inorganic and lifeless never—as they imagine—acquire; nay, that even after a time all living entities, to the parts wholly cellular which certain bodies still inorganic already, as we have seen, possess, are made to add parts vascular which no bodies entirely inorganic yet display: because they think that while mere inorganic and lifeless substances to the last remain wholly homogeneous in nature and in form—that while minerals never, to their original elements and combinations, add new and different substances and forms—all entities organic and living from the first show substances and parts different from each other: that while all mere inorganic and lifeless substances remain to the last sterile, unpro-

ductive and unable to continue their race in new individuals of the same sort, distinct from themselves, all organic and living individuals after a time acquire the power of propagating their species by a new progeniture, which detaches itself from the original stock, and commences a separate existence; and finally, because they believe that, while no aggregates inorganic and lifeless have any definite period of decline and death, all entities organic and living whatever are necessarily doomed, after a certain period of life, growth and expansion, to experience as definite a period of decline, death and dissolution.

These beliefs, in themselves unfounded, as I shall presently show, have in their turn produced other later beliefs as unfounded, and which have become more evidently absurd and preposterous than themselves, such as that of every entity, which from the first cause and creator had by the express creation of a new principle of organization and life, wholly distinct from any principle already found in mere inorganic and lifeless matter, and only experiencing further development in organized beings, received organization and life, having, moreover, in order to avoid the fresh repetition of similar express new creations at the commencement of every new entity organized and living vegetable and animal which appeared on the face of this globe, from the first parents of each living species which appeared on it, been transmitted to, and inherited by

all their later descendants, that could at any time arise in any part of this same globe: so that all the parts of these latter, not partaking of this principle already existing in their first parents, which should by degrees appear in any of these later descendants, should only be mere inorganic and lifeless ekings out.

But if this had really been the case, of every primitive individual living and organized that had been created, every later descendant, simultaneous with, or successive to another, which actually arose, or might have arisen to the end of the duration, and to the ultimate limits of the space presented by this globe, must have carried off a fresh portion of the organs included in and possessed by the first individuals from which it descended; and must thus either at each remove from its predecessors or first parents, and at each fresh subdivision of the organic parts of these, have singly of these organic parts retained a smaller portion, and have singly been less in general size; or can only have retained the same general size with these, by being individually formed of fewer organic parts, and by being made to add to these fewer organic parts a greater number of mere ekings out and expletives.

Above all, where parts organic and living had been cut away, destroyed, or wasted, no entire new ones of the same sort, not transmitted by or inherited from the first parent of the species, could subsequently have replaced them. By no injury

inflicted on the organic structure of a living entity, calculated to give its saps a new direction, before unseen in the same, or by no intervening of certain substances of one sort of entity with certain substances of another and different sort of entity, could there have been produced any new parts organic and living, different from any former parts seen, and yet, not only in themselves as fully organized as the former, but having their different organization as fully and organically connected with that of the former organized parts themselves, as if they had been of the same sort.

Yet all these circumstances, which by the very principle here set forth of all the organization of each living species being included in its first individuals, and being, in their later descendants to the last, only limited to what they inherited from these first, are represented as impossible, are seen to happen every day.

So far from every individual of each species, as it becomes further removed from its first parent, showing organs fewer in number and smaller in size, or at least ekings out and interpolations of mere inorganic matter more numerous, if by chance it happens to be placed in a situation or soil more favourable to its luxuriance and development than any its former parents more proximate or more remote, will throughout its more extensive parts every where show an organization more fine and full and close.

In the individuals of many species, for each organ of a sort forcibly removed, a number of others of the same sort, entirely new, for which there would not have been room if the first had remained, will spring forth, and will extend and ramify without end or limits; as we see in clipped hedges, and in fruit-trees pruned.

Many an animal only destined originally to have one head, and one tail, each at an extremity opposite to that at which springs forth the other, and one set of lateral limbs at the side opposite to that whence branches forth the opposite corresponding set, will, if it loses these, bring forth a new organ or set of organs of the sort, not in its more regular and uninterrupted development wanted: nay, will, if the direction of its component fluid be wholly subverted, at both extremities alike produce heads only or tails only, and on both sides produce a superfluity of limbs.

Many a flower which usually only exhibits a small and a definite number of petals, may, by a superabundance of food, have the number of these petals indefinitely increased. Reverse the situation of certain plants, so that the parts which first faced the air shall face the earth, and that those which first faced the earth shall face the air, and from the extremity whence before would have arisen fresh leaves, will arise roots, and from the extremity whence before would have arisen fresh roots, will arise leaves.

Let a plant or an animal be attacked by a blight, or punctured by an insect, the influence of whose new substances poured in it generates a disease, and it will be made to bring forth, the former some burr, or bladder, or fungus, or gall-apple, and the latter some excrescence, some pimple, some wart, some piece of proud flesh, unexampled in any former entity of the same species, whose development has not by some strange influx been disturbed, and yet throughout as fully and closely organized as the parts more sound and in the former vegetables of the sort regularly brought forth.

Finally, intermix in an individual of a peculiar species with the fluids belonging to it, the fluids belonging to another different species, and there will frequently from the union of these two different fluids arise a hybrid, not only in the parts different from those of either parent as fully organized as in those parts which it inherited from each of these, but even in the intervening links and junctures derived from neither parent exclusively and only derived from the mixture of both, and thus different alike from either singly and separately, as fully and completely organized as it is in those parts which it derived from either parent exclusively.

Now, these circumstances attending these later organizations in part superstructed on and arising out of earlier organizations, so different from those which must have attended these organiza-

tions, had there existed a positive line of demarcation between bodies still entirely inorganic and lifeless and bodies organic and living;—had the first bodies organic already necessarily included in them all the essential organic and living parts of all the other later entities organic and living that might in the course of time have proceeded from them,—and had thus in these bodies organic and living and in their descendants any later influxes from without, however much of these the intrinsic nature and relative proportions might still have remained similar to, or again have differed from those of the former influxes, still have left the first aggregates organic and living that arose out of them similar to those that were before,—these circumstances by which on the contrary, according as in these bodies by degrees flow from without new substances, in their nature, quantities and proportions similar to or different from those that flowed in them before, they are again caused to compose later forms organic and living, either still similar to or again different from the prior ones,—prove not only that as the later combinations of substances thus far singly inorganic and lifeless remain similar to, or again change from former ones, the later forms and faculties organic and living arising from their combination also remain similar to or become different from these former ones; but, moreover, prove that only from the peculiar combinations of sub-

stances before inorganic and lifeless can arise any aggregates organic and living—that only on the peculiar combinations of these substances before inorganic and lifeless must depend whether their combinations in solid and cohering bodies shall remain inorganic and lifeless like themselves, or shall become organic and living.

And this truth already a priori established, is by experience—by a sedulous inspection of the course of nature—confirmed, since, instead of their ever remaining between substances inorganic and lifeless, and between bodies becoming organic and living, a definite and a lasting line of demarcation, the former often by an insensible transition run into the latter: since, if on the one hand there be many species of bodies which, like snow-spangles and like pyrites,—the former only out of separate substances by the mere force of cold, and the latter also by the intervention of the force of heat,—composed, though they are already regularly from within made to grow outward in bodies insulated and detached from other surrounding solid aggregates, and showing in their own internal crystallization and forms a perfect symmetry, yet soon have their further growth arrested, and show no further marks of organization, life and growth, and still less of change and development of forms and faculties, and thus are called lifeless, on the other hand we see out of certain bodies themselves still de-

cidedly inorganic and lifeless, such as certain species of stone and mineral, as out of their proper matrices, arise and grow, and to the last naturally continue to cohere with these, certain other bodies still like asbestos, by the custom of language called merely mineral, inorganic and lifeless, which nevertheless, by new fluids constantly flowing in and circulating through and consolidating and cohering with their former solid parts, and thus making them extend and grow, not only on former masses inorganic and lifeless superstruct in unbroken cohesion with them other later parts having all the essential attributes of organization, life and growth, but at the same time render it impossible to mark exactly where inorganic and lifeless masses cease, and where out of them arise bodies organic and living.

And should it be asked why, if to this day, not only where organisation and life already exist ;—where individuals, vegetable and animal, already possessing the attributes of organization and life, already have been brought forth and flourish,—later influxes from without of matter thus far uncombined, inorganic and lifeless, or after having been combined in bodies organized and living, again decombined, disorganized and dead, can of this organization and life cause the further support, extension, development, increase and even change, this organization and

life cannot from bodies thus far inorganic and lifeless, by peculiar combinations take their first beginning and formation;—why from nothing yet that is organized and living do not actually to this day in our very presence and under our very eyes arise such spontaneous forms of organization and life vegetable and animal, as might assure us undeniably of their possibility and of their taking place, I shall answer firstly, that in no spot whatever any entities organized and living, except such as out of the elements thus far inorganic and lifeless by the peculiar atmosphere and soil—the peculiar climate and substances of that peculiar spot,—can be supplied, and be made to meet and to combine in the relative quantities and proportions adequate to the purpose, can spontaneously arise: that still at the frozen poles the bleak sky and the torpid earth cannot be made spontaneously to furnish the elements, thus far inorganic and lifeless, only capable of being consolidated into the forms organic and living, vegetable, animal, only able to arise out of the meeting of the richer elements, aerial and terrestrial, that can only be supplied from air and earth between the tropics: and vice versâ.

And secondly, that moreover, where already of the different species organic and living, vegetable and animal, congenial to each spot, not only the earliest, simplest and lowest, but the

very highest and latest sorts the materials have already for ages, not only spontaneously, but through the medium of the action involuntary and voluntary of prior individuals of the sort already existing, and through the channel of regular procreation, been made to meet, and to produce the forms of later individuals of the sort, to the full extent and number to which by these means the inorganic and lifeless elements existing, necessary for the purpose, could be made thus to assemble and to produce these:—where consequently from this circumstance the elements necessary for the combination, even of those higher entities, vegetable and animal congenial to the spot, have in their uncombined and inorganic state already become too much exhausted, too thinly in their inappropriated state left scattered and floating about, to be spontaneously, and without the action, the assistance and the superior attraction of earlier individuals of the same sort already existing and formed, made to continue meeting and combining into new individuals of the same sort,—where thus it required all the action, assistance and superior attraction of entities of the same sort already existing and formed, to bring about the formation and combination of fresh portions of the same substances, even in new additions to the organs of the entities already formed, and still more

form such substances altogether still thus in entire distinct new individuals of the sort, it is only in prior individuals of these same high sorts that the elements of new individuals of the same sort can be collected in quantities sufficient to lay the foundations of such actual new and distinct individuals of the species, subsequently, from want of room, by these former ones expelled and made to commence a separate existence; and it is only of these elements thus far yet inorganic and lifeless produced by the soil and climate, of which a smaller number suffices to be more hastily combined into entities organic and living, vegetable and animal, more insignificant, such as hardly perceptible mosses, lychens, and grasses, and animalculæ, worms and insects, whose existence excites little attention—which when they are not combined are not missed, and when combined excite no question, whether they have been combined spontaneously, or through the medium of prior parents of the same sort,—that at such a late period either enough can be left, or can again, by dissolution and decombination of prior organized and living entities vegetable or animal, be afresh dispersed and recast into circulation, to be in our very presence and under our very eyes again spontaneously recombined into new entities organized and living.

But I shall add, that wherever in a spot from the sky descends sufficient warmth, and from the

earth ascends sufficient humidity to meet each other, and, when left long enough undisturbed, to join and to combine into any productions vegetable or animal, some such productions, organic and living, vegetable or animal, suitable to the soil, infallibly still to this day arise in quantities and numbers exactly proportionate to the materials from above and from underneath supplied, and made to meet for their production: witness the mould, mildew, mosses, weeds, grasses, and other minor vegetables; the aphides, the musquitoes, the worms, insects, and other minor animals, which, in every spot where from air and earth a sufficiency of the elements necessary to combine into such, are made in a place sufficiently resisting their pressure to prevent their escape, and to favour or force their union, by degrees are seen to arise, though the volatility of their elements before they are out of these produced, and their minuteness and insignificance when first produced, do not allow us through the sense directly to acquire the least certainty of their formation being spontaneous, and not being produced through the medium of prior parents of the sort.

Having thus shown that there is no necessary line of separation between substances in a state unorganized and lifeless and between substances organic and living—that on the contrary it is out of the meeting and combination of substances before inorganic and lifeless in peculiar rela-

tive proportions alone, that bodies organic and living may, nay must, necessarily arise; I shall now proceed more pointedly to show how it is that out of certain different substances separately inorganic and lifeless, bodies organic and living, vegetable and animal, first spontaneously arise.

CHAPTER II.

What are the circumstances which, while some aggregates of a crystalline species remain inorganic and lifeless, cause others to become organic and living.

Of aggregates of substances still in their whole so fluid that they cannot yet by the resistance of their molecules to the pressure of new substances, from without driven and penetrating within them, be made to preserve any definite form and arrangement, no part can yet be called organic and living.

But molecules may already cohere sufficiently to offer to certain other later fluids and substances, from without driven to and in them, athwart their aggregate a definite path, or to force these to be within them condensed in certain definite later solid forms, though to our ruder contact they still so yield as to remain and appear, to our organs, wholly fluid.

Such are many substances mineral, vegetable, and animal, by us still called fluid, which nevertheless already without the intervention of any

solid parietes, resist the penetration of other fluids running alongside them.

However, of substances, already by combining electricity and by cold congealed, consolidated, and rendered cohering and crystalline, or such as to present a cellularity composed of alternate parietes and intervening interstices, some may, like snow spangles, like rime, like ice, like salts, and like all other mere mineral concretions, remain entirely inorganic and lifeless, and others, like these former still only solidified in a mere cellular form, and entirely bereaved of vessels, may already, like asbestos, like mosses, like zoophytes, and like all other later and more complex entities, vegetable and animal, become organic and living and growing.

On what depends between the former bodies merely inorganic and lifeless, and the latter bodies organic and living, the difference which leaves in the former a total absence of organization, life and growth, and to the latter first gives the possession of these new attributes?

It only depends on this, that in the former bodies, when their first molecules from opposite sides driven together and meeting are made to consolidate and cohere sufficiently to have of the new substances still fluid that enter and penetrate between them, by the pressure of electricity of a combining sort and of cold from without, and by the resistance or counterpressure of the

former solids from within, a portion again stopped, condensed, congealed and made to combine and consolidate, of these new substances from without, during their consolidation the pressure on the former ones within already consolidated, so exceeds in these former ones from within their elasticity or power to yield to that pressure of these outer ones, without being by it broken, dispersed, and decombined, as not to be able themselves to remain solid and cohering, while these new ones are added to them;—as we see in stones which when humidity driven into them is there by combining electricity and cold congealed, it soon makes them burst and themselves again decombine;—whereas in the latter bodies, when of the new fluids driven in them a portion is stopped, congealed, consolidated and made to cohere together, the extension which these new fluids experience in being consolidated in crystalline forms, disperses not by its pressure the former solids, nor decombines these entirely, but by the elasticity these possess only makes them also in their turn extend, till by their extension they again exert over the new ones consolidating a counterpressure, sufficient to make these also cohere even with themselves, and thus gradually increase the general mass of substances solid and cohering, in so doing, make it exhibit the phenomena called of life and growth.

So superior indeed is the elasticity of all

bodies organic and living over the elasticity of bodies not organized and still lifeless, that a blow which entirely severs in twain and breaks a bar of iron, will often only, while it lasts for an instant bend a vegetable filament, or animal fibre, which again resumes its former shape as soon as the pressure is removed.

Not, however, that the force of combining electricity and cold, even when in its simplest shape consolidating the later fluids penetrating in the prior solids of vegetables or animals, may not in these produce such distention as to cause decombination; but this force must for that purpose be much more intense relative to the solids on which it acts, than that in which it suffices to produce this effect on inorganic and lifeless bodies.

On what circumstance again must in certain solid bodies depend that elasticity so much greater than that possessed by others, which, when they take in from without new fluids, and when these new fluids within them consolidate, prevents them from being themselves by their pressure in consolidating broken and dispersed, and only suffers them to be by this pressure so extended as by their counterpressure to make them cohere with these new solids, and thus live and grow?

Not in these solid bodies being entirely formed of new elements differing *in toto* from the elements of the former solid bodies still inorganic

and lifeless; for of the elements and substances composing all bodies still inorganic and lifeless, a portion still necessarily enters in the composition of all bodies organized and living. In bodies organized and living as well as in bodies inorganic and lifeless, still is required a certain portion of time, of space, of gravitation centripetal and centrifugal, of electricity combining and decombining, of cold, of heat, and of substance, such as light, colour, savour, and odour, partly radiant, partly gaseous, and partly liquid, which finally become cohering and solid.

But as in bodies inorganic and lifeless these substances are not mixed with a certain portion of other substances, with which they are mixed in bodies organic and living, they are themselves in the former, in proportion to the general density and size of these bodies, in greater quantity than they are in the latter. These bodies have of these substances a less quantity in proportion to their general density and extent than the former possess.

And it is the greater number and variety of molecules of different elements and substances, possessing different definite size and shapes, combined together in the crystallizations of certain solid bodies than are combined in those of others, which causing in these latter, between these solid molecules, interstices and pores more minute and more varied, more extensible and more compressible, without breaking, than are

the former solid bodies, that superior elasticity, that power of returning the pressure they receive by an adequate counterpressure, on which depends, when new fluids are driven to and are made to consolidate in them, their faculty of being by these not broken, dispersed, and decombined, but only made with these new substances to cohere; and thus to live and grow.

That this supposition is true is confirmed by all the bodies that show organization and life, showing, mixed with a portion of the same elements and substances, indispensable to those that possess not yet any such attributes, a portion of certain other substances, of which the former possess not yet any portion whatever; vegetables already showing not only mixed with their oxygen a greater portion of carbon than is possessed by mere minerals; and animals again, having in them a greater portion of nitrogen than is found either in mere minerals, or even in vegetables; so that each of these later species of bodies again have a certain portion of certain substances, of which the former sorts are entirely deprived.

I have already in solid and cohering bodies of an inorganic and lifeless sort observed, that further pressures from without may drive new elements and substances to them, and may be let into their interstices; but I have forgotten in these solid and cohering bodies of an inorganic and lifeless sort to observe, as I ought, that be-

sides the force from without which impels these substances to those bodies, there arises in these bodies themselves a force from within which attracts these substances from without to them. It is that force which, preventing the penetration of these substances from without, where exist the solid particles of these bodies, causes their being all determined to the intervening interstices and pores; and there enables them, by these interstices protected from all sides, to be drawn in, more partially, but with greater strength than before; and it is called the force of suction.

This force, already acting in solid bodies of an inorganic and lifeless sort, moreover in bodies organic and living, whose solid parietes and intervening pores are both more minute and more numerous, even where the pressure from without inwards becomes not greater, from within acts outward with more intensity, and thereby makes these solid and cohering aggregates of an organic and living sort by degrees suck in the substances which from without present themselves at the orifice of their pores, with greater avidity and in greater quantity, than do the pores of inorganic entities.

It must already have appeared, that the first and most fundamental attribute of organization and life, namely, that of molecules of substances themselves already condensed and cohering in a solid body, so pressing on new substances driven

into the interstices or pores of that body, as in these also to be made to solidify and to cohere with each other and with the former solid mass, and still to increase that mass, and make it grow, is a circumstance which cannot be fulfilled in a single undividable moment, and must depend upon a certain length and succession of time: and as of new fluids from without the influx, penetration, solidification into new solids, and the assimilation of those new solids with the former solids already aggregated, is more slow or more rapid, more rare or more copious, vitality is in an entity still said to be more slack and feeble, or already to be more intense and forcible.

In some entities vitality may still be so slack and slow as by its imperceptible changes still to elude our senses, unless the entities be examined at very great intervals. In others it may be so rapid, as by its accelerated movements to strike our eye in a few minutes.

While in bodies new fluids are only made to penetrate, to condense and to cohere with each other and with former solids, without decombining and expelling any of these former solids, the bodies only grow slower or quicker, but indefinitely, and without experiencing any marked period of decay or renovation.

But in bodies composed of peculiar substances more fine and varied, while of certain of the prior

solids from within the resistance and counter-pressure causes of certain of the new solids from without the cohesion with and addition to them; of certain of the new solids from without the pressure inward, of certain other of the prior solids within again causes the loosening and decombination from the remainder, and through the pores and interstices between those that still cohere, their expulsion and driving out of the body: so that in the same bodies organized and living in which, on the one hand, there is a continued partial influx, combination, life and growth, there is at the same time, on the other hand, a continued partial decombination and deperdition, both going on together.

And these two opposite movements and tendencies may and do already coincide even in the seeds of the minutest vegetables, and in the ova of the most imperceptible animals.

While, however, the exit and deperdition are only partial, and while new substances coming in still continue supplying the place of the old ones going out, the body still experiences constant renovation: and even as long as the influxes exceed the effluxes, this renovation produces continued growth.

In many living entities there however comes a time when the force from without that makes them extend, is balanced by the force from within which resists their further general ex-

tension: then they no longer externally grow, but the substances driven in may still continue for a time to have its solid molecules packed closer, so as to acquire greater density and vigour: and as long as the substances coming in and those going out continue on the whole to balance each other, the body is said to be stationary. When at last the prior influxes from without produce in the interstices between former solids a density and closeness so increasing as to obstruct and impede the penetration of later new influxes from without, and when consequently the quantity of the substances from within driven out begins to exceed that of the substances from without driven in, the body is said to begin to decay.

Finally, when the decay becomes general, when no part continues from new fluids coming in to experience fresh renovation,—when thus all the faculties of life entirely cease,—complete death ensues.

I say complete death, for from the very beginning of life may already on the one hand begin partial death, while on the other hand there still continue partial life and growth and renovation: and it is only when of an entity no part whatever remains able to live, that it is completely dead. In brutes and in human beings death may already commence from their very issuing into light and may not yet be complete, even after they are again laid low in the grave,

when the fur of beasts and the hair of man often still live and grow, till all further sustenance is denied them.

The word dissolution is generally coupled with that of death: still is not dissolution always the immediate or necessary consequence of death. Death consisting in the cessation of the faculty of making new solid parts cohere with the former ones—of the faculty of life,—may still only produce the mere immobility and stationariness of the parts already cohering; may not yet be immediately followed by the dissolution of those parts. Death only in entities that have lived consisting, in the first instance, in the loss of the power of living—of further combination,—it is only after death the inrush of new fluids which, when not consolidating in the body, but fluidising the solids already in it produced before, first causes general dissolution; and this inrush often may be and is prevented.

Already the sun, the planets, and the other heavenly bodies to a certain degree solid, which from without take in certain substances, and of these substances cause a part to circulate through, and from within them again to issue outward, each possess two sorts of atmospheres: the one of the substances penetrating within them, and the other of substances again going out of them; each less or more copious, as in them exists a vitality less or more intense and active.

The atmospheres coming into and going out

of our sun—a body experiencing an absorption, circulation, movement, change and exhalation very copious and constant, and such as itself feeds every other body of our planetary system —are very intense and active.

The atmospheres coming into and going out of our moon—one of the bodies of our system experiencing an absorption, circulation, movement, change and exhalation very languid and slack—and being probably in its internal parts very solid and stationary,—are so feeble, that it often has from this globe appeared doubtful whether the moon had any atmosphere at all.

Of our own globe, the different solid bodies even inorganic that between their parietes have interstices or pores, through which from without substances still fluid enter, penetrate, circulate and again issue, already all have atmospheres, but still very intermittent, weak and attenuated.

On this earth the substances radiant, gaseous and fluid, more copious and varied, that are constantly driven to and left to penetrate in, to circulate through, to consolidate with, and again to decombine and drive out the former substances of bodies organic and vital, must on the contrary cause an atmosphere coming in and going out of these organic bodies, more copious and constant than any bodies inorganic and lifeless can display; but in these latter, as in the former bodies, the atmosphere absorbed inward always retiring from us, and evading the touch, can

hardly by us be distinctly perceived; and it is only the atmosphere emanated outward and advancing towards the feel which we can distinctly perceive. While the former, in man called inspiration, is never, before it enters him, more condensed than in a state of gas, the latter is, under the name of exhalation, often so accumulated and condensed as to appear at the very surface of the body collected in the shape of a positive liquid called sensible perspiration. But as different organized and living species are in part composed of different substances, and as the substances good for one entity may be bad for another, vegetables that are stationary and riveted to a peculiar spot, often by degrees cause the elements they imbibed from air to exude and accumulate in the same spot on earth in such quantities as to render that spot injurious to other vegetables, composed of elements very different.

At different periods, these opposite atmospheres, the one coming in and the other going out in the same entities, each differ in the intrinsic nature and in the relative proportions of their component elements.

During the day-time, and while of the elements and substances from the sun emanated and sent forth, a greater quantity and number reaches the surface of this earth, and that of the objects situated upon it, of these substances the pressure on and influx into these objects is so

much greater as to check and repress the efflux outward of the substances, by former influx made to enter and seeking to issue; and keep them as it were imprisoned on the threshold.

At night, and when of the elements from the sun sent forth little or none reach that side of the earth and of the bodies situated on its surface, where that night prevails, the liberation of that pressure and influx of elements sent forth from the sun, causes the substances again from within solid bodies pressed outward, to be less impeded and to make their exit more easily: and often substances from within, which in the day-time the greater pressure from the sun arrests at the threshold, at night and when that pressure ceases, are suffered to escape, as then does from plants the carbon and from animals the nitrogen, which, where thus again let loose in great quantities, totally change the quality of the atmospheric air around them.

Though I have from the inferences of the mind stated what circumstances must first produce in solid bodies the elasticity which enables them to become organic and living, I think it impossible from the impression of the sense to determine what are the sort of bodies in which that superior elasticity first begins to exist in its minimum degree. Its beginning is insensible, and so must, where it only reaches a very low degree, for a time remain its growth. It cannot yet be said to take place in such solids as the

spangles of snow or the congelations of rime; though the former already from within expand in the concentric radii of a flower, and the latter in the diverging ramifications of a plant; because their growth, accomplished in an instant, is of short duration, and when once it ceases, does not recommence: it may already begin in the filaments of asbestos, which seem to grow during an indefinite period; in the dots or flakes which light, heat and humidity combined by degrees form and extend, under the name, I believe, of lepra, over the panes of a piece of glass which has long remained unwiped; in those green incrustations which the autumn's damp brings forth from stone; or in a thousand other bodies, having a perceptible and a gradual and a continued increase and growth.

As all the solid formations of this globe, mineral, vegetable and animal, first arose from fluids, the French naturalists of the present day, rather, I think, confounding fluids, among which still belong gases, with liquids which must be later compounds of gases, seek in the remains of that sea which once covered the whole surface of the earth, the earliest and simplest solids, not only inorganic but organic and living, vegetable and animal. They there trace them in the mucous matter which first solidifies in the mere cellular form of the chaodiniæ, the ulnaceæ, the confervæ, the laminariæ, the fuci, the hydrophytes, and the other vegetables which the

sea produces, and many of which, in their great toughness and in their brownish hue, resemble thongs of leather. They consider all plants growing nearer the surface of the earth, and wanting more air, as of a later date. But air, composed of various gases, has preceded water as well as land: and of these gases many may have been in that very air, without the medium of water, condensed and combined not only in solid bodies of an inorganic and lifeless sort, such as hail-stones, snow-flakes, ærolythes, &c. which only afterwards their growing cohesion and gravity impels to and causes to form and to increase the solid nucleus of the earth, but even in bodies of an organic and living sort, such as the epidendra formed in air, which when heavy enough to fall, attach themselves to bodies inorganic or organic rising from the earth, that serve them as supports and fulcra for further growth; and still more evidently those aphides, which, after one of those collapsions of elements called a blight, generated in air, often put forth wings which continue to support them in that air; without at all reaching the solid bodies growing from the earth upwards.

Mere gases however can in air, or even in water, be consolidated in bodies organic and living which, while remaining in that element without any support afforded by a substance more solid, are liable to be by winds or waves buffeted

about, and less able to take a firm root, and to enjoy in their infancy a screen, a protection, a hold, a resistance and a fulcrum, than those formed nearer the solid bodies of the earth: but only the minuter or lighter ones remain in that air, and those which grow larger, denser and heavier, soon seek either the earth itself, or the earlier organic solids rising from the same.

Like the materials of globes themselves, the materials of all the lesser organic aggregates vegetable and animal that again arise round these globes, beginning to derive their solid form from converging gravitation which, from all sides without presses more equally upon them, before diverging and centrifugal gravitation from within again makes them expand more partially outward, first appear agglomerated in the more lumpish and huddled shape, the vegetables of a seed, and the animals of an egg, before they again show any more partial ramifications outward.

CHAPTER III.

Why do bodies, as they become more fully and variously organised, in a sound and healthy state, let out more heat?

THIS question has puzzled people very much. Methinks it admits of a very easy solution.

All substances, while in that state of fluidity which precedes a state of combination, imbibe, intermixed with that electricity of a combining sort which on emission produces a feel of cold, a great deal of electricity of a decombining sort which on emission produces a feel of heat. When by the electricity combining and productive of cold they are combined, that electricity decombining and productive of heat is again driven out, and made to penetrate into, and be felt by the organs of sensation. Thus already the fixed stars and the sun are made in their constant combinations to send out a certain degree of heat, of which a portion reaches, and is felt on our earth.

When the substances round our earth itself are consolidated and made to cohere in solid bodies, the heat which was in them mixed with

the cold, is likewise partly driven out; but as the consolidation of mere mineral inorganic and lifeless bodies only takes an instant, the extraordinary heat which is evolved during the act of that mineral consolidation also only lasts an instant, and soon again disperses; when only the cold which in the body consolidated has superseded that heat, is, on touching the same, partly evolved and felt.

Even if new heat from without is afterwards again made to penetrate into the body cohering and consolidated, it only tends, when great, to its decombination and dissolution, and at any rate is only, while it overflows and again is partly suffered to escape from the same, by the organs of sense perceived and felt.

Not so does it fare with solid bodies of an organic and a living sort. In these the case is different. In these of elements and substances coming from without in a fluid state, the solidification and the union with former solids is permanent, and so likewise is with it the evolution from them of that heat which was harboured in them prior to their consolidation.

Thus it is that already the simplest plants not from a heat, produced only in them by later application from without, but from a heat already from without renewed, whenever new substances from without still continue to penetrate in them and to increase their growth, evolves portions

more copious and more lasting than after they once are consolidated do evolve mere minerals: that in plants, as they have a vitality more active and rapid, this heat which they evolve still increases; that in animals, in which fluids from without more various combine and consolidate, this heat again acquires greater intensity; and that in animals themselves, finally, as they are of a higher sort, and become more complex, this internal heat they collect and evolve again becomes greater. They are only a focus which constantly from without imbibes imperceptibly, and again emits from within, perceptibly, a greater quantity of heat.

When organic and living bodies, from first being sound and in good health, and causing new substances flowing in them to be combined rapidly, and thus to evolve much heat, by degrees fall into bad health and disease, and thus cause new substances flowing into them to be combined more slowly and imperfectly, they take in from without, with a smaller quantity of substance, a less quantity of heat; and this heat again by the cold from within less constantly kept in motion and evolved, makes them feel aguish and chilly: until this heat, by its own greater concentration and by the additions of other later heat from without which continues to enter and to be added to it, again from within obtains a sufficient preponderance over the cold

that kept it confined, to be able athwart that cold and the fluids which it kept condensed, to break forth, to occupy, and fill the body, to be felt by it more generally, and to drive out the cold and the congelation by it produced, in the shape of copious perspiration.

In tropical climates where the general atmosphere remains more fine and more elastic, and receives greater quantities of the radiance both of heat and cold from the sun, and of the pressure of gravitation from the moon, not only from the tides of the sea, but from the alternate pressure of cold and of heat on the human body, the vicissitudes of the cold and hot fit of an ague coincide more with the movements of the sun and moon than they do in temperate and cold climates.

Some entities of an organized and living sort, when cold increases greatly in the atmosphere without, and penetrates in, and compresses, and expels the heat which entities previously harboured, and causes all the fluids they contained and circulated through them to experience a rapid and sudden combination, congelation and arrestation, thereby are made to cease being capable of assimilating food; and, when these entities are of an animated sort, also to cease being capable of harbouring sensation, thought, will and impulse to voluntary action, and fall into a state of corporeal and mental torpor; in

which state they remain, while this preponderance of cold continues; and this is called a state of hibernation.

When from an internal cause, such as the obstructions opposed from within by the substances already cohering, the entrance of fresh substances from without is made to diminish, the influx of fresh heat from without is likewise made to decrease: as there is less heat coming in from, there is also less heat going out into the atmosphere, and less perspiration: the limbs feel colder.

But from mere weakness and want of power to retain even the substances already received within, whether in their fluid or solid state, at last arises a driving out of these and a perspiration, which neither caused nor accompanied by heat, feels clammy and cold, and is not only the internal effect but the external sign of that weakness; and generally is considered as a symptom of approaching death: when no further substances, and consequently no heat whatever, continue to be taken in, and the body remains for a time consigned to unqualified cold.

As the climate is naturally colder or hotter, it favours the combination of organized and living entities that require either more cold or more heat for their further increase and growth: but in hotter climates in which, together with substances, penetrates more of that heat which longer

keeps these substances distended, unconsolidated and uncohering, there is room for a penetration of substances more copious and varied before they do cohere; and thus are produced bodies from their first commencement more large, luxuriant and rich, and which require supplies more abundant for their further continuation and increase.

In all temperatures alike, the substances that are within those elements called water and earth —themselves already less permeable to heat— condensed in entities organized and living, such as fuci, zoophytes, molluscæ, worms, fishes, amphibiæ and even certain quadrupeds, cause in their creations and growth less heat to flow in together with their inflowing fluids, and thus less heat to be driven out in the consolidation of these fluids, than flows in, and again is emitted by the entities like insects and birds made to live in thinner air.

In organic and living entities the heat that from without with fresh substances ever continues to penetrate inward, where again it is by the consolidations of these entities emitted, prevents not only the fresh cold which from without attempts to penetrate, from being so easily admitted as it is in bodies inorganic and lifeless, but even prevents fresh heat from without from penetrating so rapidly as it may in bodies inorganic and lifeless, and from gaining so speedily

over cold that preponderance which, by destroying the balance between the two opposite elements, may, fromt heir being both in certain relative proportions beneficial, in other relative proportions, be rendered injurious.

Thus it is that in living bodies the cold from within offers a more effective shield against the excess of heat from without, and the heat from within offers a better ægis against the cold from without, than each does in entities still inorganic: and that as organic and living entities possess a vitality more intense and more active, they preserve, amidst the greatest changes and vicissitudes of the external temperature, an internal temperature more equable and calculated to resist the opposite extremes of the former.

CHAPTER IV.

How in bodies organic and living, from the superabundance of elements, substances and saps from without continuing to flow in, and forming cellular concretions, of these cellular concretions some are again converted into vascular concretions, which carry the saps flowing in them in greater quantities, more rapidly, to a further distance; and more favour their remixture with other elements, substances and saps, from the opposite side without coming in; and again cause of these new compounds the consolidation in new forms, cellular and vascular.

Many people think that vessels are one of the first conditions of vitality: because bodies not vital never have vessels; because bodies endowed with vitality, as that vitality becomes more active, have more vessels; and because where to cellular concretions are added vascular concretions, the former shrink in the background; the latter eclipse the former, and standing foremost, strike the eye so much more directly than these former ones.

This, however, is an erroneous opinion; firstly, because all organic and living entities arising out of inorganic and lifeless ones, and even inorganic and lifeless bodies themselves, already have a cellular and crystalline formation; secondly, because a vascular texture, though found in no inorganic entities, is not found in all organic entities, and a mere cellular and crystalline texture, spreading horizontally, and called in vegetables parenchyma, and in animals reticular texture, is found in many entities vegetable and animal of a simpler sort, such as tremellæ, nostochs, algæ and zoophytes, in which no vascular organization whatever can be found; thirdly, because where in organized entities a vascular system at all arises, it only arises after and on a prior cellular system; fourthly, because in many organized entities, in which, as in monocotyledinous plants, the cellular system is very extended, the vascular system still is very incipient and restricted; fifthly, because each vascular system, composed of peculiar substances, different from those of another prior vascular system, only arises after and out of the materials and upon the base of a peculiar earlier mere cellular system, also different from the former cellular system, and composed of the same substances that compose the vascular system which it immediately precedes and supports:—because each vessel only is composed of some prior concretion of cells

and parietes, first only disposed in the shape of laminæ or follicles, before the saps continuing to run athwart these laminæ or follicles, by their increasing quantity and weight so begin to press down their centres as to make their margins from both sides curl up, reapproximate, and rejoin over where they first diverged, as to form cylinders or tubes, which permit the fluid driven in them to accumulate and pass on unimpeded in greater quantities more rapidly to a greater distance, before it again is arrested and consolidated—as we see in the first formation in seeds and ova of their vessels: sixthly, because a peculiar mass of cellular organs, disposed in follicles, thus serving as foundation, as material to every mass of vascular organs, also of this latter to the last rules the formation, disposition, direction, support and growth; seventhly, because where the fluids are from one side through these vessels driven forward, and are not at the other opposite side again poured out in air in the shape of evaporation or exhalation, but are at that other side by the resistance or opposite pressure of other elements and substances different from these first, coming from that other side, resisted, they have their molecules, before huddled together in a stream, again with these fresh substances arranged as before into a peculiar set of mere cellular and laminar solids, only different in size and shape from the

former ones, before by fresh superabundance of the saps that formed these, a part of them is again moulded into new vessels; so that each new set of cellular concretions precedes and itself forms each new set of vascular concretions; as well as each new set of vascular concretions divides and separates each set of cellular concretions, from the next set of cellular concretions.

While thus all bodies merely inorganic and lifeless have the fluids they receive in an almost instantaneous period solidified in a mere cellular form, without afterwards having any of these cellular forms again, by the accumulation of new fluids, transformed into vessels, capable of carrying these fluids in greater abundance more rapidly athwart a greater number of cells to a further distance, certain bodies organized and living may, to cells disposed in certain cohering layers only extended straight forward, add certain of these layers moulded into tubes or cylinders called vessels, again on certain of the prior outstretched ones founded, from which these fluids again are poured forth to be either exhaled, or with fluids coming from the opposite sides moulded into new solids, first again cellular, and next also again vascular.

It is clear that the force which makes the laminæ before extended be depressed in the centre, and that which makes them curl up at the sides, must be, the former a gravitation cen-

tripetal, and the latter a gravitation centrifugal, and thus both be forces acting vertically, and in a sense contrary to that in which fluids are in vessels impelled latitudinally from one extremity to the other, and which thus appears to be electrical: a thing which is confirmed by electricity, as it is weaker or stronger, propelling fluids in the vessels with less or more rapidity.

When, however, from the form of the body the fluids are made to flow through the vessels in a horizontal direction or even in a vertical direction centripetal and downwards, and press not particularly on the parietes of these vessels, they leave them throughout their length smooth; and thus continue to flow through them to their furthest extremity uninterruptedly: but when by force of gravitation centrifugal they are made to flow through these vessels upwards in a centrifugal direction, their weight, pressing backwards on the parietes of the vessels, scoops these out at certain distances into bags or valvules, which by partly supporting these fluids against the pressure of that of centripetal gravitation, and preventing their being made by the same to fall backward, assist the force from underneath in carrying them forward.

When organized bodies are formed, between air and water, where the pressure from above on them is resisted by the counter pressure from underneath, the cells and vessels only extend

between the two elements in a horizontal direction, and if at the extremity of the first or a former set of cells and vessels, spreading horizontally alike in all directions, a new set of elements and substances from within, by the resistance and counter pressure it meets, moulds a new set of cells and vessels, this new set of vessels only formed of a continuation of the same elements of which were composed the former vessels, can only assume the same nature and form; as we see in the confervæ floating on the glassy pool, which have not yet in their extension, wholly lateral and horizontal, any distinction between parts shooting upwards, and parts shooting downwards.

But it fares differently with organized entities, which first entirely formed in air, are made partly by the pressure of centripetal gravitation to elongate and grow downwards to the earth, and are next again by the centrifugal gravitation from that earth arising made to elongate and grow upwards in the atmosphere.

In these, after the first cellular concretion from within growing outwards has produced a first vascular concretion also going outward, the parts of that vascular concretion which face the sky, from which descend only elements lighter and finer, and those which face the earth, from which only rise elements more dense and aqueous,

each only, with these new elements from without wholly different, produce, the one upwards and the other downwards, new cellular concretions wholly different, and which each again in its turn produces a vascular system wholly different from that produced by the other. Of these two systems, cellular and vascular, wholly different, in vegetables the one driven down, remains in its way to or in earth more huddled together, and takes the name of radicle or root, and the other pushed up, and finding in air more varied counter pressure, and yet more room to extend, becomes more flat and spread, and takes the name of plumule or leaf; but the new saps, by the mixture of new elements and substances from underneath rising formed in the cells of the radicle, are by the centrifugal gravitation from underneath pressing on and through the new vessels that spring from these cellular concretions below, carried upward and made to ascend, and the new saps by the mixture of new elements and substances from on high formed in the cells of the plumule, are by the centrifugal gravitation from on high, through the new vessels that arise from these cellular concretions above, carried downward and made to descend.

So much indeed are in vegetables, having one way distinct roots, descending downwards and seeking the earth, and having the other way

distinct leaves, ascending upwards and seeking the air, these roots one way universally formed of the saps descending downward being made to mix with the aqueous fluids, which the centrifugal force drives up from the earth, and these leaves the other way universally formed of the saps ascending upward being made to mix with the aerial fluids, which the centripetal drives down from the atmosphere, that in some vegetables, like the bramble in England, and the banian tree in India, from the very extremity of their branches, nearest the sky, the parts that face the earth and the elements from that earth driven up, are still made to drop down roots to that earth; and that in some other vegetables, like the sallow and the poplar, from the very extremity of their roots deepest buried in the earth, the parts that face the heavens and the elements from the atmosphere driven down, are still made to shoot forth fresh buds and leaves into air.

And if the roots always have forms lumpish and huddled together, and the leaves on the contrary have forms regular, spread outward, and often complicated, this proceeds from the component molecules of roots only in their extension and solidification from that earth encountering a counterpressure lumpish and huddled, whereas the leaves in the air, in the extension and arrangement and solidification of their molecules meet from that air without with a counterpressure

more elaborate, more finding room to extend and develope, and more adapted to the peculiar nature and form of the solid molecules over which that counterpressure is, from on high, exerted.

Before, however, I proceed further in my account of the fate that awaits in organized and living entities these two opposite fluids, the one composed chiefly of elements ascending from the earth, and the other chiefly of elements descending from the atmosphere, let me here stop an instant to discuss the words which I am obliged to use for the purpose of describing various modifications, in order thereby to facilitate their comprehension.

At the first steps in every science, and while on retrospect the differences of a later and more superficial sort by which entities are again distinguished, strike the sense and intellect more forcibly than do the earlier and more deep hidden similitudes concealed under these differences from which they themselves spring, and by which they are at their origin united, many things, in consequence of these differences, are distinguished by different appellations, which afterwards, and when we dive deeper in the subject, we find to be, from their earlier similitude and origin in a common source, entitled to a more generic common appellation; and then the names more specific which mark and are exclusively attached only to these differences, by fixing the mind more

exclusively on them, and preventing us from attending so much as we ought to their more deep laid similitudes which precede them, prevent the progress of science, which all new words coined were at first intended to forward.

This defect is greatly felt in studying in different entities the attributes of symptoms of organization and life. We find that modifications that are fundamentally the same in entities merely vegetable and in entities of an animated description, are marked in each by appellations wholly different; and that thus we only are left to infer the resemblance which the similar appellation in both should itself have directly announced. We find that thus the multiplicity and diversity of signs for the same things prevents our rapid perception of that similarity which in those things really exists, and which all signs where it exists should express; and that instead of facilitating, these signs only render more difficult and more confused the comprehension of the things they are intended to mark.

Thus in common parlance we call entities that share in the attributes of organization and life, not first and generically by the name of those attributes they alike share in—not by the name of the attributes of organization and life, which renders them both alike different from entities destitute of organization and life, and which assimilates each fundamentally with the other—

but only by the distinct names of vegetables and of animals.

Thus again, both in vegetables and in animals, we call the solids more immediately, on being from a fluid state consolidated and crystallized, merely cellular; and when of these cellular concretions and laminæ a part is rolled up in tubes and cylinders, we give them the name of vessels, though their parietes still retain their fundamental cellular structure.

Thus in vegetables we call exclusively seeds, and in animals ova, the earliest distinct form, in which their component substances are collected in a single cohering body.

Thus we call in vegetables the earliest shape of that body by the name of cotyledon, and in animals by the different name of placenta.

Thus we call in vegetables exclusively parenchyma, and in animals exclusively rete mucosum, that concretion of solids merely cellular and laminar, which in both entities alike precedes and forms the foundation and first stage of every later and more partial vascular formation composed of the same substances.

Thus when the first and most fundamental saps that form the cotyledon or placenta are, by new mixtures from without, one half with saps from the earth rising upward, and the other half with saps from the sky descending downward, made to divide in two different sorts of

saps, we call in vegetables those from on high descending, merely descending saps, and those from underneath ascending, merely ascending saps; whereas in animals, we call the first lymph, and the latter chyle.

Nay, when in animals of a later and more complex description, besides the aerial elements entering through the external pores, there are similar pores perforating internal cavities, these latter entirely lose their name of surface even internal, which they have a right to retain, and only according to their size, depth and number receive the different names of tracheæ, bronchiæ, or lungs, stomach and bowels.

I allow that of these different names, those that only mark a different stage of development in the same organs, may be necessary to express this difference; but those which only mark the same stage of development in different entities, are superfluous, and if not commented upon, as I said before, serve only to confuse instead of clearing up our ideas.

I shall, therefore, as far as custom will permit, preserve the remembrance of the original formation and of the resemblance arising from it, throughout all the later differences of substance in which that resemblance may be shown, in vegetables and in animals; and shall, by way of rendering more distinct and clear my denomination of the saps, different from each other, which are

produced by the remixture of the first and most fundamental fluid on one side with new elements from on high, and on the other with new elements from underneath, call the one sort which from on high descends, the aerial, and the other which from underneath ascends, the aqueous sort, both in vegetables and in animals.

The point in organized and living entities at which of the fluids of the first and most fundamental sort, in the first instance throughout homogeneous, a part is made by their weight to descend, and after partly with new aqueous elements from the earth underneath forming new solids, cellular and vascular, is through these new solids again made to arise, and another part is made by the resistance to this weight and the counter-pressure thence produced to ascend, and after partly with new aerial elements from the air above forming opposite new solids, cellular and vascular, is through these new solids again made to descend, is in vegetables and animals called the umbilical point.

In most vegetables, and in a few of the lower animals, after the homogeneous and similar fluids have from this common umbilical point started in opposite directions, and are again from opposite quarters made to return differently modified from what they themselves were at first, and each differently modified from what the other is, a part of each, not finding room to flow out and eva-

porate above or below, but resisted and prevented by a part of the fluid of the opposite sort, is again made to revert inward; and when it is there also resisted, is made to form into new opposite solids, similar to the former opposite solids, which, again driven beyond these, superstruct or substruct beyond them new additions to the former fabric, through dint of a see-saw, which continues till the vessels obstructed or overlaid by others refuse their office.

But in higher organic entities of the animal sort, in which to the elements that, when organized, only live and grow, are also superadded other elements that, when organized, feel and think, and display will and voluntary action, for want of room these same opposite fluids, aqueous and ascending, and aerial and descending, only continue to be directed to, and to increase and invigorate to the end the very same opposite forms, cellular and vascular, till at last they obstruct and cause them to decay and to die; which they consequently do in a more definite period.

But of this and other differences between mere vegetables and most of the higher animals, more hereafter.

I shall first here only make a few more remarks, which I think equally applicable to vegetables and to animals; and specify a few more attributes in which each still resembles the other.

CHAPTER V.

The same circumstances that, in productions of nature, produce peculiar generic wants, also produce in them the means of obviating these wants.

When we find that if of each planet only one side receives at a time from the sun the influxes of light and heat wanted for its support and benefit, we also find that this deficiency of simultaneous light and heat supplied all round, is compensated by the planet turning its different sides in quick succession to the sun; that if of our peculiar planet each different part naturally produces peculiar entities, vegetable and animal, different from that of another part and having different wants, it also is naturally provided with the peculiar means to obviate those peculiar wants; that each animal whose stomach and interior requires a peculiar species of food, also, as soon as he begins to want the same, begins to be provided with all the peculiar external organs of pursuit, prehension, attack, and defence best calculated to cater for the wants of that peculiar stomach and inside; that while vegetables, and even those animals

that need not for providing their means of subsistence, organs of locomotion, possess none such, entities on the contrary requiring them each possess the exact sort suited to their wants; that the earth-worm, destined to live in the narrow and tortuous bowels of the solid globe, and to whom a body dense and rigid would be an incumbrance,—would only impede his underground progress,—has a frame slender, elongated, smooth, elastic, and flexible, able to wriggle itself athwart the narrowest and crookedest interstices and sinuosities of the element across which lies its path, while the aerial insect, enabled to perform its various movements through a thin and yielding atmosphere, has his light body by long and spreading wings easily buoyed up in air; that the animal first produced in water and first only possessed of the narrow lungs and short limbs required to support him in water, when afterwards he is lifted up in air, also puts forth the wider lungs and longer limbs requisite to support him in air, and from a worm turns to a fly; that the fish, destined for the aqueous element, has in the internal air bladder and in the external configuration lumpish but sleek and provided with short fins, all that he wants for his varied movements in the denser medium that surrounds him, while the bird, destined for a more aerial abode, possesses the internal expanded chest, and the external extended pinions, calculated to cleave the finer fluid of the atmosphere; that every animal has the

peculiar covering of scales, of feathers or of fur, the peculiar weapons of attack and of defence, the teeth and claws best adapted to the peculiar exigencies of his abode and situation; that in living and breathing entities the ascending vessels which want valvules to support the fluid rising in them have such valves, while the descending ones, which want none such, have none; that in all animals what is good for the stomach and body is also grateful to the sense, and *vice versâ*; when we find all this, I say, we are apt to consider, between the wants felt on one hand, and the means given on the other hand, in order to supply these wants, the peculiar coincidence as the immediate effect only of certain after-thoughts of Providence, which unable, as it were, to avoid producing the wants, has, after producing them, bethought itself of the means of obviating their effect; in the same way as man does, when, having discovered in his handy work a peculiar imperfection, not foreseen, he seeks and devises some remedy for the same not previously thought of; and we extol the wisdom and goodness of God for so doing, as if, even according to human modes of viewing things, it would not have been wiser and better not to produce the peculiar wants at all, which require such remedies, than to have, with the peculiar wants, also provided the peculiar remedies by which they may be supplied.

This, however, seems but a confined mode of contemplating nature, and of lauding nature's

Author. Already in many cases in which at first sight we thought that we only perceived for the wants produced in different entities such *ex post facto* remedies, we have on more mature investigation discovered that nature, instead of having first produced the imperfection or want, and afterwards having, by a later and separate act of thought and volition, produced a remedy or a cure, not arising spontaneously out of the same cause as the imperfection or want itself, but only more lately applied to the cure or supply thereof, the very same circumstance, prior both to the evil and to the remedy, that caused the one, itself also laid the foundation of the other; that the evil and its cure had the self-same prior source.

Thus we have already found that the very same modifications of the laws of gravitation which caused round more primary globes, throughout resplendent with light, the formation of secondary globes more opaque, and which could only from the former derive the light which their surface wanted, also caused these secondary globes to revolve round these primary ones, so as to make every part of their surface in turns successively receive this light, required from the more primary globes.

We have already found that each entity, vegetable and animal, spontaneously formed on this globe, is here, wherever it naturally and spontaneously arises, made to find all the elements it wants for its further support and increase, pre-

cisely because it first naturally and spontaneously arises only out of the very elements, already in their unappropriated state peculiar to that soil and climate; and because organic and living entities only want for their further and later support and growth, elements of the very same sort with those out of which they first were formed.

We have already found that if, in vegetables and animals, at peculiar periods, and when for pursuing, prehending, and appropriating to themselves the substances they want for their further support, they also want new external organs and limbs of a peculiar sort, which before, and while they wanted not any such, they received not, this new accession of means of providing for their new wants only then takes place, because at that period the nature of the new elements they begin to take in more copiously and to want more constantly, themselves also from within causes an ebullition, an expansion outward more forcible, producing those very limbs more prominent, which are necessary to take in those new external elements more readily and copiously.

We have already found that in the herbiverous ox that same diffusion and laxity of component parts, which internally, and for his further support and increase, only wants the juices less concentrated of herbs with which he fills his wider paunch, also only causes that same more extended carcass externally to put forth from its sides those extremities and limbs less developed,

less capable of quick pursuit and prehension, and only armed with an obtuse hoof, only capable of supporting him on the level pasture; and only from its anterior orifice—its face—to sprout forth those teeth, likewise more blunt, only fit to bruise the tender herbage; and that in the carnivorous tiger, on the contrary, which internally and for his further sustenance and growth wants the juices more concentrated, only afforded by prior animals, to fill his more contracted stomach, that same increased vigour alone also causes that same body less bulky and more condensed, to put forth those limbs more powerfully knit, ending in claws more extended, more ramifying, and more sharp, with which to pursue and prehend, and in those teeth more piercing, with which to tear and to assist him in swallowing his prey.

We have already found that while in vessels through which the saps descended, as there was no necessity for the saps descending being supported, there was no provision made for their support, in vessels through which the saps were to ascend, and where a provision for their support was necessary, their very weight during the ascent scooped out in their parietes the valvules necessary for support during that ascent; we have already seen that if beasts in certain of their organs require a peculiar extension to make them conducive to the peculiar purposes for which they were intended, these purposes themselves, first only wanted in a less degree, gradually also,

by the elements they serve to take in, gives them that further extension required; that if man so constituted as to want food more various than brutes, also receives organs more various than brutes for its prehension, its mixing, its maturation, its mastication, its digestion than brutes, this is because in man, from the very first composed of elements more various than brutes, the forms in which these elements are united and made to develope, afterwards produce both for their support those wants, and for the supplying those wants those means more various and complicated exhibited by brutes; that if a peculiar part or organ suffers some extraordinary injury or destruction, the supply of fluids that before was employed in its support, now pent up, accumulates unemployed till it is collected in sufficient quantities to supply the loss, and to supply an entire new part or limb of the same sort with the one that has been lost. In short, we have already discovered so many instances in which peculiar wants and peculiar provisions to supply those wants, both arose out of the same prior common source—in which the same prior circumstance produced both the want of a particular object and the supply of that object —that we have reason to suppose, in the instances in which we do not yet see this harmony and coincidence between the want and the supply—in which the want only proceeds from one circumstance, and the supply appears only to proceed from another later different circumstance, inde-

pendent of and distinct from the former,—this circumstance only arises from our not yet being able to look far enough back, and to take in a scope of objects sufficiently extended, to arrive at the common origin of the want and of the supply: we are founded to believe that if we could only take our survey of surrounding objects from a globe sufficiently elevated, central and early, we should find a common origin and source for all the distinct natural wants we experience on this more late and partial globe, and for all the distinct and different natural means we find to obviate these wants.

In the present system of the universe, and particularly on the present globe, extensions and movements from within outwards, unfoldings and developments, are not always made to go on in uninterrupted progression, but are by Providence, in many times and places, through the division of matter in smaller portions, only made to alternate with resistances and checks, returns and retrogradations, envelopements and unfoldings. Through that division of matter in lesser portions, after from each separate point part of that matter has been made to advance to a certain distance outwards, it is again by meeting another portion of that matter, from a different point advancing outward in a different direction, checked, repelled, made to revert inward, to return nearer the point whence it first set out, and there again to meet another portion of matter, in the succession of time and the extension of space

developed after it, by which it is also again on that side, in its retrograde direction, arrested; so that both in time and in space its advancement may be said to resemble a spiral, which, at certain periods in its progress returns to points near those where it first originated, than those which in the intermediate periods it had reached.

As an example of this circumstance—a leaf is first formed straight in its vessel. It is next made, as it extends, by the resistance of that vessel and the want of room in it, to infold; until it again is driven out in air, and there left to unfold a second time to a wider extent: the same happens to an animal in the womb.

Even men who think and talk more philosophically than the vulgar herd of mankind, think and talk as if in nature of extensions and developments, forces and faculties, the progression, once begun, went on without further check or hindrance. In doing so, they overlook that in this universe, and particularly on this narrow globe, instead of the later changes that progressively arise out of earlier ones, whether in the world of mere time and space, in the world of simple forces or also in that of substances, in the world mineral, vegetable, animal, sensitive, intellectual, and reactive, in the world purely natural or also artificial, being all new unfoldings and developments, many of these changes on the contrary are only, for want of room to unfold, new envelopements and infoldings, that only in later and

further times, from more distant points of space, bring back things nearer to the points of space whence they first started: that in time and in space, by the laws and modifications of gravitation centripetal and centrifugal, and of electricity called positive and negative, by the conditions of alternate cold and heat, and by those of every other sort of force and substance, instead of each portion of each of these different later attributes that arise out of the earlier ones having an indefinite extension, and progress, and movement forward, and growth, each is again, at a certain distance from where it set out, exposed from an opposite quarter to meet with a resistance, check and counterpressure, which again makes it recoil, retrograde, revert backward in the direction in which it had advanced; move, act, and impel in a sense opposite to that in which it had moved, acted, impelled at its first departure, and even at that later period and in that further space, within the former unfoldings and developments, again find later unfoldings and developments, which it again arrests, checks, or by whose superior force, and extension, and swell, and pressure it is itself made to burst, break, and dissolve—that, in other words, all things have their pulses, their alternate extensions and contractions, advancements and recedings, pressures and counterpressures, floods and ebbs, comings in and goings out.

Man forgets that already long even before distinct worlds had begun to exist, of the very earliest forces that arose out of the mere combination of time and space, and that in their turn again became the parents of every later modification of force and of substance, mineral, vegetable, animal, sensitive, and intellectual—of the force of gravitation in short, which pervades the whole of the known universe—certain portions were in their progress again by certain other portions of that same force of gravitation so checked, arrested, repelled, and made to recoil, as to revert backward, and, from centripetal and advancing inward, to be made to turn round, to circulate, and again to become centrifugal and advancing outward.

He forgets that when, out of portions of gravitation centripetal and centrifugal, from opposite sides meeting and combining, again arose that force called electricity, that electricity only when from opposite sides converging, in its convergence inward produced the pressure of cold and combination; and that when its opposite rays by again meeting were again made to recoil, to diverge outward, and to dilate what they had before compressed, they again by their expanding force produced heat, and decombination of what the former electricity had combined.

That it was only the combination, the arrestation of the force of gravitation and of prior

electricity, by later electricity from opposite sides compressing produced, that out of mere forces produced what are called substances.

That only by forces and substances first radiating, which from opposite sides were made to converge, till they checked each other and combined together, were first formed the earliest and largest and most centrical and primitive globes; and that in part from rays of force and substance from these globes again made to recoil, and to advance in a retrograde direction, till they were again at a distance from the former globes by the later rays converging to the same, arrested, resisted, checked, and made with these to unite in a more stationary aggregate, were produced round the more primitive globes other globes later and lesser.

That only out of the opposite pressures of these primary globes on the secondary ones, and counterpressures of the secondary on the primary ones, arose those revolutions which the secondary globes describe round the primary globes, and which at certain periods make them return to the points whence at prior periods they started.

That on this, and probably on many other second or third rate globes, after substances first radiant are by compression and cold converted into gases, liquids and solids, these solids are again by distension and heat, reconverted into liquids, gases and radiance.

That on this likewise, and probably on many other second and third rate globes the elements of bodies are divided in reigns merely mineral, or also vegetable, or moreover likewise animal, distinct and separate from each other; and each of these reigns are again divided in genera and species equally distinct and separate from each other, each of which species singly and individually, after it has from its most incipient points and limits extended and grown to a certain degree, is by the opposite extension, resistance and counterpressure of certain of the other species, prevented from extending further.

That the same which happens to each genus extrinsically and relative to other genera, happens to different portions simultaneous and successive of each individual genus intrinsically. That of the different portions simultaneous and successive of which its whole is composed, each part, after a certain degree of extension and growth, is by the extension, growth, resistance and counterpressure of some portion of another genus, or of some other individual or portion of the very same genus again counteracted and repressed.

That of each individual each separate component portion is in the same way after a certain degree of extension and growth, even by some other neighbouring part of the very same individual checked and prevented from extending

further, nay made in later time to decay, die and dissolve; that certain parts exhaust other prior parts, though the medium of which they were first formed and supported, and next, themselves, for want of the further support of these former parts, die and dissolve.

That in organized matter and bodies only pressures and counterpressures, advancements and retrogradations from opposite points, ever successively more numerous and more diversified, produce all the divisions and differences of a later and more minute description, first in systems vital, aqueous and aerial, chyliferous or lymphatic; next, and arising out of the reunion of these, in later systems sanguineous, veinous and arterial; and next again, in systems sensitive and mental—in systems of thought inward, and of voluntary reaction outward—which arise out of and are superstructed on earlier and more general divisions and differences.

That in this organized and living world, after the pressure from within to opposite points without less or more numerous has made parts vital, sensitive, intellectual and reactive each individually begin and extend to a certain degree, the further counterpressure of later parts from without on them again makes their own later and more external parts turn back, fold over their earlier and more incipient parts, and enfold and envelope these, before by their swelling they

burst and break and dissolve the barriers that checked them, and again a second time expand more amply and fully.

That thus in vegetables, the different systems of cotyledons, of roots, of leaves, of parts aqueous and parts aerial, after having developed to a certain degree, are each again by the later pressure they meet with from without, made to double down, and to fold themselves in, till by swelling and pressing against the integuments later formed round them, they liberate themselves from these, and again develope and expand on a larger scale.

That in animals in which the case is the same as in vegetables with the mere vital parts, the process still is repeated more minutely with the additional parts sensitive, intellectual and others, not possessed by mere vegetables: that these too after certain evolutions outward are again, by certain barriers from without placed around them, made to form further involutions, till such time as, by their swell breaking these barriers, they again expand afresh.

That some of these evolutions, like that of the brain, for which there seems not room on this globe, await to take place on another globe higher, roomier, and more central.

That this not only is the case with the more primary entities of each species, but that these primary entities, of the different increasing elements and saps which they cannot in any other

way find room for and dispose of, and which even within themselves still remain distinct and separate from them, form the nucleus and lay the foundation of other similar evolutions and involutions, developments and envelopments in others first formed within their parents, which in their progress are, for want of room, sooner or later made to detach themselves from these parents, and to begin a separate existence.

That even in the vegetables and animals, composed of parts different from each other more numerous, more varied and more complex, in the incipient stage of their individual progress, and long before they have reached its utmost point, certain parts, such as those aqueous and those aerial, each singly take so much room, that the further development of the other opposite parts cannot continue fully to go on in the same individual: that whichever begins by having a preponderance crushes the other, and only singly continues its further development, and that thus of the two different sexes, composed by the predominance, the one of the parts aerial, and the other of the parts aqueous, the completion can only take place in two distinct individuals, of which the conjunction is again necessary in order to bring together all the elements that are necessary for the production of a third individual, in its earlier and more fundamental parts possessing all

the requisites of the species, and all the attributes that shall make it resemble either parent.

That in each individual the pressure inward and the consequent later extension outward, far from ever increasing, are each after a time again so resisted and counteracted, the one from within and the other from without, as to turn to stationariness, decay, death and dissolution; so that some entities will go down hill and disappear, while others appear and rise in their stead.—

And finally forgets that on this globe all the difference between one reign, genus, species, individual and part of an individual, and another, only consists, as I said at first, in the extent to which its development is carried, before by some counterpressure it is again made to shrink, to decay and to disappear.

CHAPTER VI.

Causes of generic forms and individual deformities.

As of each different substance, each different side already in its radiant state, to forces dividing and compressing it, offers a different degree of resistance, when by forces of electricity of a combining sort a substance first undivided is divided and compressed in lesser molecules called gaseous, of each substance each component molecule, as we have seen, offers a peculiar size and shape, always similar in all the molecules of the same sort of substance, and always dissimilar in molecules of different sorts of substance.

And when of these molecules of a single sort of substance a certain number are made to fit on to each other, and to cohere together in a large body, in the way they are best calculated to fit on to each other and to cohere together, this larger body must likewise, from the peculiar sizes and shape of its lesser component parts, and from the direction in which these lesser parts are naturally made to cohere, assume a shape always the same in bodies composed of the same, and always

different in bodies composed of dissimilar substances.

Nay, when molecules of a certain substance are naturally mixed with molecules of a different sort of substance, in the relative number, proportion, and situation in which they naturally fit on easiest to each other, and cohere best together, the sort first and most generally predominating, must among the different other sorts later presenting themselves, also cause those sorts in preference to penetrate withinside the former and to cohere with them, which can best in peculiar relative proportions and dispositions penetrate within and cohere with these. If different sorts present themselves at the same time, an election must be made between them; the fittest to cohere with the former must be chosen, and that in the fittest quantity; and thus substances must always unite with only definite new substances, and with these new ones only in definite proportions: where the first leading substance is similar, all the remaining substances added to it must be, regularly, similar; and where the first leading substances are different, all the remaining substances added must also be different.

This already takes place in bodies, in which all the substances cohering are seen to cohere at once, where there is not elasticity enough to let later cohesions succeed the first, and which, con-

sequently, to the last, remain inorganic and lifeless; and it equally takes place in bodies whose greater elasticity allows later cohesions to succeed earlier ones, and which thus become organic and living.

It already takes place in organic bodies whose extension, being latitudinal, on all sides remains similar; and it likewise takes place in those whose extension being perpendicular, and, partly upwards to the sky, and partly downward to the earth, by making them face two opposite elements, from above makes them take in such elements as are different from those they take in from underneath; and thus, in one sense and at one end, makes them add to their former substances new substances different from those new substances which they add to their former substances in the other sense and at the other end.

Nay, if two individuals who in time become of sexes different from each other are again later required to unite in order to bring together a sufficiency of all the elements of which they themselves were first composed, and of which other entities like them must be first composed, these two individuals must each have the sort wanting in the other, in order with that other to compose the full complement of the elements required to begin a new individual, composed of the same elements of which each of the parents was first composed, before one sort of element gained such a preponderance as to exclude the other sort.

Though, to be sure, the preponderance of certain of the peculiar elements belonging alike to both parents, which exists in one of the parents, may be so transmitted to the offspring, that that offspring may in forms, features, movements and manners, and even in turn of intellect and disposition, have an individual likeness greater to one parent than to the other—even where that offspring has never seen that peculiar parent, and cannot be suspected of having derived this greater similarity to the same from imitation.

Thus it is that already in an acorn which developes in an oak, we not only find the reason of all the generic forms different from those of the acorn, that only proceed from it in that same individual oak, but the reason of all the successive generic forms that proceed from it in all later oaks that may again in their turn from that first oak descend to the end of time.

And that already in an ovum which developes in a tiger, we not only find the reason of all the generic forms different from those of the mere egg that proceed from it in that same individual tiger, but that proceed from it in all the later tigers that may arise from the first of the species, unto the utmost confines of the globe: even long after the first vegetable or animal of that species, which determined these later forms, itself exists no longer.

When in an object of nature—in an acacia leaf, in a narcissus flower, in the insects called

asterias and papilios, in the brute and in the human being, we see the most perfect symmetry of forms and colours; when of each of these forms and colours of which we behold a specimen on one side, we behold the exact counterpart on the other side, we cannot help at first attributing this exact symmetry, so pleasing to the eye, to a refinement of art. We imagine nature at work in her study, artfully combining the forms and hues that by their symmetry and their contrast will most gratify the sight.

We are indeed so much accustomed in the works of nature to this symmetry, that in those fewer objects, whose forms and movements have it not—as certain crystals which are rhomboids, certain plants, whose leaves, like those of the begonia, have their lobes awry; certain animals, like the oyster, whose features are crooked, or like the crab, whose gait is sideways, and even like man, whose liver is pushed on one side, and whose heart lies unbalanced on the other, it is all we can do not to regard these peculiarities, generic, and inherent in the whole species as they are, as being nevertheless defects and deformities.

Yet in natural bodies both their symmetry and their want of symmetry, when generic and pertaining to the whole species, have in nature their undeviating causes, which must precede the existence and the taste of man.

When the first forms of a solid and cohering

sort which in nature arise, have other forms of a later sort added to them, whether the stream of these later substances penetrates withinside the mass of the former solids, and divides this in two halves separate from each other, one to the right and the other to the left of this central current, or whether in its fluid state this current is itself again by these former consolidations, driven outward to the right and left of them, and made round these first to divide and consolidate into two distinct aggregates, enveloping the former mass, the result equally must be, without any study or design such as man might display, in the different forms simultaneous and successive that arise from the process, some peculiar symmetry simultaneous or successive.

This symmetry we see to exist in most minerals, vegetables and animals, in their substances, forms, hues, and consequently movements and actions, all disposed to the right and the left of a central line: and thus it is that in individuals composed of many parts simultaneous and successive, that symmetry which we regard as one of the last efforts of art, is already one of the first attributes of nature.

But, as we have observed, not symmetry, but a certain peculiar definite want of symmetry, is in some entities mineral, vegetable and animal, a generic and undeviating attribute: some have a certain generic obliquity and twist.

Where this is the case, the very first and leading molecules already in their forms have that twist, which they transmit to all later and more external ones superstructed upon them. It is the twist which we find in the crystals called rhomboids, in the vegetables of the begonia tribe, and in the animals called pleuronectes. It is the peculiar twist in their forms which makes spiders and crabs creep sideways.

In certain organized entities of a higher sort, and in which are formed a greater number of parts and organs than the later integuments formed round them leave room to remain in the symmetric position relative to each other in which they were first formed, the symmetric disposition itself may gradually be defeated by the pressure from without which causes these parts to be huddled together, in the way which the relative order of their formation, and the relative fitting of their forms to each other may determine, especially where the internal contents grow faster in size than the external capacity of the envelopes that contain them: and thus it is that in higher brutes and in human beings the liver is shoved to the right by the heart, and the heart shoved to the left by the liver.

Besides this formation and this disposition of parts simultaneous and successive, more regular and generic, which takes place when each sort of molecules, earlier made to cohere with an-

other sort, has, among the later ones which present themselves in preponderating quantities from different quarters, the choice which soonest and easiest to admit and to cohere with, there may be cases where the accidental or wilful proximity and preponderance of some other sort of molecule, somewhat less fitting than the former, or in proportions somewhat less suitable than the former, is yet fitting and suitable enough to be, in the absence of the former, attracted and made with the substances already solidified to combine: and thus arise new forms not yet beheld, less generic, less regular than those thus far seen: as appears in entities made to display the peculiar forms of some disease, or the forms of two different entities mixed in a hybrid.

But this forced conjunction is so rare and so difficult to produce, that it only becomes in its turn prolific, and only again produces an offspring, where the parts united are very congenial to each other; and that even then, where to that offspring has been left an option in its further conjunctions, these will insensibly make its own later offspring again return to the forms which first preponderated; and that where the conjunction takes place between parts which are less congenial to each other, it produces no fruit, no offspring whatever, and remains wholly sterile.

CHAPTER VII.

Many bodies organized and living of a vegetable sort, to their first and most fundamental central parts merely cotyledinous, add other parts more extreme, again different from the first and from each other: partly facing the earth and called roots, and partly facing the air and called leaves; on which are again founded other parts still later.

I HAVE in my first volume shown that if, to the elements that still leave bodies too little elastic to make them become organized and living, is only added a sufficiency of carbon, they are rendered elastic enough to acquire the organization and life of vegetables; and that if to these elements is again added a sufficiency of nitrogen, they again are rendered even elastic enough to acquire the additional organization and life of animals: but that these new elements, again added to those already possessed by mere minerals, render in these latter bodies the whole quantity of elements, only wanted to form mere mineral again proportionably less.

I have next launched out into some episodical observations relative to certain attributes,

which mere vegetables and animals possessed in common.

I shall now again resume my account of the progressive developments of the first and simplest sort of organized and living entities—of vegetables,—before I pass over to that of the more complex sort—of animals.

We have already seen that in those vegetables beyond the very first and simplest sort, which only have a single species of mere cotyledinous formation, expansion and growth, and which to the very last may be said in that expansion and growth to remain merely cotyledinous—among which sort of vegetables, perhaps, belong those early and minute bodies, allied to the byssi, tremellæ and other cryptogamous plants, which redden the polar snows, give a green or gray or yellow tinge to the water, or to the solid mineral bodies on which they expand, and generally, only lying on a flat surface between heaven and earth, only expand latitudinally—are those that, situated between heaven and earth, have a longitudinal expansion both upwards and downwards; and from their first parts cellular and vascular, composed of fluids descending from the air and of fluids ascending from the earth, which meet, mix and combine in these solids cellular and vascular, again pour forth a part, of which part one half, by gravitation centrifugal from underneath determined upwards, is by gravitation centrifugal

from on high, with new elements descending from the atmosphere converted into new saps and solids, cellular and vascular, of a description more aerial than the first fluids and solids, called leaves, which again send the superfluous saps flowing in them downwards, and of which the other half, by gravitation centripetal determined downwards, is again by gravitation centrifugal from underneath, with new elements ascending from the earth converted into new saps and solids cellular and vascular of a sort more aqueous than the first, called roots, which again send the superfluous saps flowing in them upwards:—and have seen that, when from the first and former leaves, the superfluous saps are again by gravitation centripetal made to descend, and when from the first and former roots, the superfluous saps are again by gravitation centrifugal made to ascend, those portions of those two opposite saps which cannot each advance in their opposite directions, till they each find an outlet and evaporate, the one in air and the other in earth, but are made to meet, check, and arrest each other, are each again, by their stoppage from before made to receive from behind a greater pressure, the one from underneath and the other from above, are each again made on the spot to receive fresh consolidation, the one in fresh leaves and the other in fresh roots; which fresh leaves and roots, first formed withinside and between

former leaves and former roots, are again driven, the leaves upward and the roots downward, till they again find an outlet, generally beyond the former ones; and there, by further elements taken in from within and from without, complete their own expansion, and to the former leaves adding new leaves, and to the former roots adding new roots, thereby increase the multiplicity of opposite organs of the plant, and the size of its whole.

Seeing that in many plants, in which to leaves and roots are added stems, branches and twigs, at the end of the season, when the more tender and delicate leaves drop off and die, these more solid stays which support these leaves continue to live and grow, and to remain uninjured by that cold of winter to which the former yield and give way, one would at first sight suppose that it was these stems and branches which supported the leaves.

Yet the contrary is the case. Leaves and roots rise and descend before the stems, branches and twigs are born: stems, branches and twigs are only the later sturdier offspring and development of these tender leaves: since, firstly, many plants that already have leaves and roots have not yet any stems and branches,—witness the cactus; since, secondly, where stems and branches exist, they are only the further elongations of the vessels that proceed from the leaves and roots,

and which, elongating in opposite directions in the intermediate space between the one and other, there cross each other and form together the fasciculus of vessels ascending and descending that composes these stems and branches; since, thirdly, these vessels, elongating in their opposite directions with unequal speed and to an unequal length, often only ultimately arrive in the same time at the same goal, by means of one of the two sorts being by the other, which stretches out more slowly, and only stretches out in a straight line, forced to elongate in a spiral; and since, finally, the vessels from above, where entering the fasciculus formed by the vessels from underneath, generally are by the resistance of these latter made to do so with such difficulty as there to cause around them an enlargement, and themselves to experience a strangulation, which, when the autumn torpifies the saps, make the place of this forcible entrance that where the elongation of the leaves loses its cohesion with the twigs, snaps asunder, and, causing these leaves to detach themselves from the twigs, branches, or stem, causes them to drop to the ground.

CHAPTER VIII.

Vegetables monocotyledinous and vegetables dicotyledinous.

In plants in which, as in grasses, graminæ, and in the palm tribe, the cotyledons are only single, they first not only at the lower extremity near the earth shoot forth a single root, but at the upper end next the sky send forth a single plumule or leaf, of which the aerial descending fluids, when arrested by the aqueous ascending fluids of that root, are only made to form new leaves composed singly and not in pairs: and, when from the aerial descending fluids of former leaves are formed these new leaves, also each single, which, arising from a single base continue to form a single bunch or tuft, this single bunch, however much it may by successive increments rise in height, does not much increase in number of leaves, or in general size.

But there are plants of which the first cotyledinous aggregate becomes by a pressure centrifugal which penetrates it so divided as to form two separate cotyledons or halves: and while even in this aggregate the vessels elongating downwards still are, by the pressure of gravitation converging, united in a single root, the vessels driven upwards are, by resistance of the

same gravitation, made to split in two separate plumules, or in a pair of plumules or leaves: and when of the descending fluids of former pairs of plumules or leaves are formed new leaves, which again are driven upwards, these new leaves are, from the same cause with the former ones, always rendered double, and are at each remove from the former ones and from their own first origin made to spread farther and to form bunches more numerous, and more extending the size and diameter of the plant.

And while in the monocotyledinous plants the single fasciculus of vessels, descending from this single bunch of leaves, forces its way athwart the inside of the former vessels of the stem, and by the difficulty it finds in doing so, does not sensibly increase the number of vessels in that stem, nor its general diameter, in the decotyledinous plants on the contrary the numerous fasciculi of vessels descending from these numerous separate bunches of leaves, shape their course around the outside of the former vessels of the separate twigs, branches and stem; and form round the prior rings of vessels of which the branches and stem were composed, new distinct later circular rings, of which the outer ones are called bark, and enjoying room enough, distend at will, and materially increase the thickness of that stem itself.

The elongation of the vessels of the leaves downward, which with the elongation of the

vessels of the roots upward form the stem and branches, are first disposed in the shape of hollow tubes or cylinders; and, when these vessels have not room for their exsudations externally, vent their superfluous fluids in insudations internally, which crystallize under the name of medulla or pith: and sometimes, when the accumulation of rings of later vessels outside over the earlier ones within becomes great, these later vessels, by pressing the former close together, destroy the hollow inside, and render the interior quite solid. The medulla or pith is then probably made by pressure from within to form horizontal vessels or tracheæ outward, and through these tracheæ to be forced out, without its deperdition being a loss to the plant.

While in monocotyledinous plants the stream of life, internally concentrated in a single fasciculus of vessels, terminates in a single bud, and when that bud is destroyed leaves no other buds to keep up that life and to replace it, in dicotyledinous plants, on the contrary, this life, having its stream divided between numberless branches, which each lead to and from as many distinct smaller buds, may still, when in some it fails, continue to flourish in others: nay, when the inner rings of saps ascending and descending totally rot and decay, be replaced by other rings which have been woven round them, and which again weave round these other rings still wider and more ex-

Even round an old and cankered plant new healthy buds engrafted on it may weave a tissue, first of vessels descending and next of vessels ascending, which, themselves terminating in other new healthy buds, will renovate and strengthen the vegetable.

Both from the vegetables that send their new vessels from on high downwards withinside the former ones, and from those that send their new vessels from on high downwards withoutside and around the former ones, when there are a great number, some will only find room to suffer the new leaves they form to arise outside the fasciculus of the former creations, and there to constitute what are called suckers, which, when divided from the original stem, may form a new separate individual plant.

In plants, especially dicotyledinous, the fluids contained in the vessels ascending and descending which meet, often arrest and press upon each other so as together form cellular nuclei called glands, and from these glands to be forced out and to form vessels, in a direction intermediate between the opposite vertical directions of the former vessels, namely, in a direction horizontal; by which the fluids collected in them are thus again poured out as through gutters; and which are called tracheæ.

CHAPTER IX.

All bodies organic and living, vegetable and animal, through the pores and interstices that separate their solid parts, of the silica that floats in the atmosphere, take in a certain portion, which they again, mixed with other substances, exsude, and which outside these pores collapses and consolidates in an epidermis, through the perforations in which further elements from without can only be driven in regularly in such moderate quantities as to contribute to support, feed and renovate, without injuring, the intervening solids.

We have already seen that among the substances first radiant, next gaseous, which from general space around are driven to our atmosphere and globe, there is one called silica, which on this earth is found by itself, in a mere mineral state, condensed and consolidated in great quantities and masses.

Of this silica, of which already in the very atmosphere water and ice imbibe a great deal, a great quantity is on earth by organic bodies vege-

table and animal absorbed, and in the process of their circulation again driven on, till from their different parts exhaled, it collapses and solidifies over these parts, and becomes to them and to the whole body a solid integument called epidermis, which, only through the pores, naturally by constant influx and efflux between the solids of that very epidermis preserved, letting in and out the other substances in such quantities as may support and benefit the solids underneath, serves these solids as an ægis and barrier against such an irruption of substances from without inwards, and such a deperdition of them from within outwards, as might prove injurious to that body,—a circumstance we see exemplified in entities around us, when by tearing off this epidermis we leave them more liable to external injury; and which we feel in ourselves when, by scratching off our own cuticle, we leave the dermis underneath, before by moderate influx of elements from without affected agreeably, even by that moderate irruption of these same elements affected painfully.

As the friction and pressure on the parts protected by an epidermis becomes greater, it enables those parts, by resisting the efflux of this silica more, and forcing a greater quantity of it to consolidate round them, better to resist that friction and pressure; as we see in the soles of

the feet of quadrupeds, and in the gizzards of birds.

In trees, when these trees become large and strong, no longer want an epidermis to protect the parts underneath, this external epidermis often bursts, breaks and falls away.

In many organic entities vegetable and animal, in which through the pores of the body, athwart the voids of the epidermis, again are made to flow out, together with other forces and substances, streams of electricity, these streams, themselves separately prolonged withoutside the orifices of the epidermis, in their turn prolong these orifices into long tubes or cylinders, called, according to their substance and form, down, stings, spikes, bristles, hair, wool, feathers or quills, which in general become stronger at those edges and extremities of the plant where the efflux is more copious, as they do in young leaves round their rims, in insects at their articulations, in kittens in their whiskers, in colts along their mane and down their tail, and in human beings in the hair round the prominent parts of their body. Sometimes, and in peculiar states of the atmosphere, the general evaporation of electricity from the body being stopped, that evaporation appears at the extremity of these hairs increased in visible sp

Not only in vegeta[illegible]t even in animals,

those parts which grow to such a size and consistency as no longer to want the protection of a delicate epidermis, this epidermis begins to crack, to peel off and to disappear. This we perceive not only on the stem of such trees as birch, but on the hide of such pachydermata as the elephant and the rhinoceros.

CHAPTER X.

Some vegetables by degrees to their more primary and essential parts cellular and vascular, ascending, descending, and transverse, and to the epidermis in which these are enveloped, add other ekings out, within, called wood, and without, called bark.

In many of the vegetables in which the roots and leaves elongate in vessels forming between them those neckings called stems or stalks, branches and twigs, these neckings remain so flexible that, at their rising above the ground underneath, the pressure from the air above weighs them down, and makes them, like the ivy and the woodbine, creep along the surface of the ground, unless they are by some more resisting solid body buoyed up, and assisted in their further ascent. In other vegetables, no doubt more porous, the expanding leaves inhale from air a sufficiency of that aerial element called carbon, to make their vessels descending exsude the same in the shape of a sap called alburnum, which in the stem, branches and twigs crystallizes round the vessels in the form of a fibre, elastic and shining, of which the collective mass

is called wood, and which, to the parts round which it solidifies, imparts rigidity enough to support these in a centrifugal direction without any other assistance.

Every season which gives a plant a new accession of leaves, and from these leaves a new ring or sheath of vessels descending to the roots, also through the carbon or alburnum exsuding from these new vessels, weaves round the former layers of wood a new layer, which only seems to reach to the surface of the ground, and there to be stopped by the resistance of the earth from further descent: nor does indeed wood seem required lower down, as the roots, steadied by the solid earth around them, would only by the accompaniment of a surrounding sheath of wood lose that flexibility which they require to penetrate the interstices of this earth.

By degrees the later and more external rings or tubes of wood, thus woven round the earlier and more internal ones, by their compression, cause in these former rings the saps no longer to ascend or descend; when, deprived of their vital fluid and energy these former rings lapse into that state of inertness and siccity in which they become what is called heartwood, but also, for want of power from within to resist undue influxes from without, become more liable to be by these influxes injured and dissolved, even while the later and more external layers, still

alive, remain capable of greater resistance and of increase. These latter rings are then, by way of distinction from the former, called bark.

In vegetables in which, as in aloes and in yuccas, the leaves last as long as the plant, or at least have no regular period of decay, the distinction of heartwood and of bark is not discernible: but in those in which prior leaves are by other later leaves, rising beyond them, at a definite period pushed off their stools, even though the saps should continue all the year round in some degree to ascend and descend, and to leave the plants what is called evergreens, the difference of the heartwood and the bark already becomes in them more distinct: but it is above all in those vegetables in which, long before the new leaves of the spring make their appearance, the old leaves of the previous autumn are by cold made to have their fluids torpified, their solid forms detached from those of the supporting branches, and these branches for a long time stripped of foliage—and which thence are more decidedly called deciduous—that the distinction between the heartwood and the bark becomes more fully marked.

In many vegetables in which the warmth of the summer alone had kept a portion of the saps sufficiently liquid to let them ascend and descend, and feed and renovate the parts already solidified, the winter's cold congeals all the remainder of the saps to such a degree, that these saps cause

in their solidification, and in the new arrangement this produces, the former cells in which this solidification takes place, so to distend as again entirely to separate, to break and dissolve: when by the frost the vegetable again has the coherence of its parts, and the life that depends thereon, entirely made to cease.

In vegetables more hardy, more tough, more cohering, and more able to resist the winter's cold, this dissolution does not take place. In many vegetables in which only the former leaves are by new leaves developing beyond them made to intercept and monopolize all the influxes from air without which ought to go on feeding themselves, left, even in the height of summer, to starve and decay, the branches that bore these leaves still remain uninjured: and even in many vegetables, in which the former leaves are, even before the new leaves expand, more prematurely by the very cold torpifying the saps that rise in them left to starve and drop off long before the new leaves appear, while the tenderer leaves are thus cut off, the robuster and less penetrable branches remain able throughout the winter to resist the effects of external cold, to protect the fluids flowing in them, and from year to year to produce new leaves and roots, which give increasing growth and extension.

CHAPTER XI.

In organized and living entities of the vegetable sort the saps descending are by partial impediments and breakings out, and the saps ascending by partial obstructions and accumulations, made to form, to the more essential parts internal or external, partial additions or excrescences.

Many plants, nay animals, cause certain of the fluids they inhale from air through their leaves, in their descent downwards to pass out through their tracheæ or transverse ducts, and at the orifice of these tracheæ to elongate in tubes or prickles, from which, while the hard sheath often occasions a wound, the fluid running out through that duct, flows into that wound, and fills it with a matter often detrimental to the living parts in which it flows. Such are in nettles their down, and in wasps their stings.

Certain plants, growing in places comparatively arid, nevertheless from air suck in moisture enough, to cause that moisture, when from within it is again driven to the surface, under the epidermis, or in the calyx of leaves and flowers, again to be collected in quantities sufficient to quench a man's thirst.

Other plants, when from the branches and stem they again exude substances which they took in from air through the leaves, have these substances by pressure from without so moulded as to form stipulæ, brachteæ, tendrils and claws, which, formed out of the descending residue of the leaves are, in fact, themselves only abortions of leaves. Of these some are made by the pressure from without to take such a form as, when from one side pressed against a solid body, on the other side round all the convexities and concavities of that body so to cling as to buoy up against it the very stalks of the plant from which they proceed. Others are, by sucking in the air from bodies to which they adhere, even made to cling to such forms as are quite smooth and polished.

In some vegetables the vessels from the roots arising experience in their way upwards to the leaves obstructions or strangulations, which cause the saps flowing in them to be arrested and made to produce local accumulations and swellings, often by man for peculiar purposes of his own much prized and praised, and, by his care in overfeeding the plant, increased to what in himself would be called dropsy, and what even is, relative to the plant itself, a defect or a deformity.

Such are in certain solanums, turnips, radishes, carrots, beetroots, celery, parsnips and others, those enlargements, remaining chiefly cellular

and parenchymous, in the potato plant formed near the very extremities of the roots, where these roots ramify downward in other later roots, and in the other plants named formed higher up, and nearer where these roots approach the strangulations in their vessels caused by the ramifications of the leaves upwards: such are in the bulbous plants those parenchymous enlargements which, as the plants grow older, are experienced in the lower leaves themselves: such are in the *chou-rave* those swellings higher up still in the stem, where that stem, arising from the lower leaves, supports the higher and later leaves; all which enlargements, as they increase, divert in their production more of the saps from underneath that would otherwise have continued to ascend till they formed the pulp or parenchymous part of the fruit or berry: and finally, such are round the more essential parts of the fruit or berry itself those integuments merely crystallized and pulpous, which, in cultivated melons, gourds, pumpkins, oranges, lemons, apples, pears, plums and peaches, and even in raspberries and strawberries add so much to the enjoyment of man, and so little to the intrinsic faculties of the plant.

There are vegetables, such as those called ananas or pine plants, in which, after the roots and leaves have produced those later parts which are called separately male or female—blossoms or fruits,—they again athwart the very stems which

these form, produce one way new roots and the other way new leaves; of which the latter, when from that stalk which runs through the fruit, and put it in immediate contact with water or earth underneath again detached, immediately again push forth new roots, on the same principle on which all other buds are able to do the same.

There are other vegetables again which, composed of more nitrogen than the generality of plants, and thus in their nature and hue more approaching those of animals, under the name of fungi, are made to spread their leaves outward in the shape of a single cohering mass, or in that of a number of concentric follicles, more resembling the gills of animals: but even in these plants the formation of the roots and leaves still follows the same general rules as they do in all others, with regard to their relative order of growth and position.

CHAPTER XII.

Vegetables manifesting certain powers of movement, more generally only possessed by animals.

Certain vegetables already exhibit peculiar external movements, which, in general, only proceed from peculiar internal thoughts; and which, therefore, are apt to give these vegetables the appearance of already possessing powers of thought, and of being in reality animals.

Such are the movements which vegetables not attached to peculiar solid spots exhibit when they float about, and shift their situation at the pleasure of the winds and waves.

Such are in other vegetables the power possessed by their leaves and branches of approaching from a distance the place overhead whence flows heat or light, or the power possessed by their roots of approximating from afar the place underneath, whence flows aqueous nutriment: that of avoiding an intervening spot which is sterile, and of describing a circuit in their way to one more fertile.

Such is in certain creepers the power of turn-

ing their limbs in the direction that affords them the best prospect of support.

Such is in the sensitive plant the power, when touched, of shrinking, of closing its leaves and of drooping: in the dionea muscipula that of closing its fangs over the fly that steals the honey of its nectareum, and retaining the insect in its clutches till it dies: such is in the hydrargyrum girans the power of fanning the air in hot weather, so as to diffuse a grateful coolness.

And this idea of powers of sensation and thought residing in certain plants seems the more plausible, as there are other entities who, like zoophytes, with the powers of sensation that constitute an animal more clearly ascertained, still retain that attachment to a peculiar soil, and those forms partly aerial and partly aqueous, separate from and opposed to each other—that absence, in addition to external pores for the influx of nutriment and the efflux of feces, of an internal stomach, answering these purposes more sensibly, which from most vegetables again distinguish the higher animals.

Indeed, if the entities here described as doubtful, already like these zoophytes, derived their peculiar powers of movement from peculiar faculties of sensation, they would in reality already, like these zoophytes, be decidedly entitled to the name of animals, since organs and faculties of sensation are those that render all animals again

different from mere vegetables, and that in them constitute animation.

But this is not the case: vegetables that exhibit these deceptive movements, only do so from some purely mechanical cause, which implies not any feeling. Those that, far from the light, only turn their leaves athwart intervening obscurity to where from on high that light is perceived, or that, far from water, only bend their roots, through intermediate air, to where aqueous nutriment from underneath arises, and only circuitously advance to the latter, only do so because they already, from the spots to which they advance, draw such nutriment as make them elongate particularly in those directions, even before this process yet becomes perceptible to our senses.

If in the high grass the stalks of the daisy grow longer, and in turf often mowed remain shorter, so as always to accommodate its disk to the level of surrounding solid bodies, and keep pace with them in its direction, this is only because, in high grass, the pressure of light and air that prevents the further rising of the flower, is interfered with and stopped by the counter-pressure of bodies rising from underneath, at a greater distance only from the ground than it is in lower grass.

Vegetables that far yet from other solid bodies, already turn their tendrils to these bodies, only

do so because on the side of these other bodies the pressure of air to the same, being intercepted, leaves the pressure they themselves from the opposite sides experience to these bodies, to preponderate, and to drive them to their surface.

Where the sensitive, rudely touched, contracts its leaves, or the dionea, insidiously robbed of its nectar, extends its fangs over the culprit, this is only because the pressure mechanically produces these effects; and where the hydrargyrum girans fans the air, it is only because its fibres are alternately by cold compressed and by heat dilated.

CHAPTER XIII.

From the rules of nature there may be deviations; there may be defects and deformities; and as entities become more complex, and those rules thus become more multifarious, the deviations from the same may also increase.

People sometimes imagine that things may go wrong before they go right. This, however, cannot be. What we consider as wrong can only be a deviation from what we before already considered as right; and things can only be considered as going on rightly, by going on in a certain definite way, during a period of time sufficient to consider that way as the regular rule.

But in reference to certain other portions of the universe already created, and caused to exist, and to go on for a certain length of time, prior to the existence of this individual globe, this globe itself, which is only of a secondary and later formation, may already from its very first launching have had its imperfections and its defects.

And such undoubtedly it has, from its very commencement, already had. Irregular and faulty undoubtedly were from the first its move-

ments, compared with those of other globes more early, more central and better poised in surrounding space; and from this first great defect, exhibited by the obliquity of its position, and the irregularity of its movements, must in the sequel have been entailed upon it a train of other defects more late, more partial, and more subdivided:—from this original sin must have flown a variety of less faults in its formations and developments mineral, vegetable and animal, physical, intellectual and moral—of which to this hour we feel the consequences.

Of these defects a part would be generic, and beset all the individuals of its different species, mineral, vegetable and animal alike. They would be part of their very essence. Such is the great defect of the component elements of each species being divided among a number of different individuals, simultaneous and successive, distinct from each other, each only singly formed of a very small portion of the elements that compose the whole of the genus, and each in its individual interests interfering with those of the remainder of the individuals of that same and of other genera, so that of the organized and living species, each individual is, after a short period of expansion and development, doomed to a state of decline, death, and dissolution, in order to make room for others.

There are other defects which are not inherent in the whole of all or of certain species,

and as much generic as their very excellencies, but which are only incidental, and to which only from their peculiar situation, certain peculiar individuals of each species, as individuals, are liable.

Already the simplest congelation or crystal which, formed as it should have been according to rule, ought to have had throughout its aggregate alternate pores and parietes of a certain peculiar homogeneous substance and form, may by some accident be made to show deviations from that homogeneity, which renders it defective. It may be made to exhibit internal flaws or external lesions, which make it appear deformed; and as entities, substances and bodies, in order to be formed according to rule, require conditions, forms and faculties simultaneous and successive more numerous, more varied and more complex—as from inorganic and lifeless, they become organic and living, in more various ways and degrees—they also become liable to offer, from the rules laid down for them, deviations more numerous and more striking.

Those defects coeval with their first formation, and arising out of irregularities in the first impulses which they received, where in their further development they become very marked, are called monstrosities; those only arising from external accidents subsequent to their first formation, are called mere defects.

Already vegetables may in their growth and

development show a number of defects and deficiencies to which mere minerals, having no such successive growth and development, cannot be liable. However, among the very defects of vegetables—among the very circumstances in which they deviate from the acknowledged rule—there are many still which, to eyes and minds not accurately versed in all the rules belonging to the development of vegetables, and only intent on contemplating their later and more superficial effect on the sense of man, still pass for peculiar merits and beauties.

Such are in peculiar plants the etiolation of their leaves, the supernumerary petals of their flowers, the very extraordinary swell of their fruits, which renders them to us more luscious and more palatable. We admire the varied stripes of the ribbon grass, the various spots of the tulip, the golden edges of the variegated holly, the numerous petals of the double rose, the swelling pulp and succulence of the peach, produced by the Parisian gardeners. All these circumstances, in their faintest degrees already exceeding the rules of nature, are still by the art of man sedulously increased.

But in most animals the rule itself already becomes so much more evident, that in these entities, corresponding deviations from it, in general already at the very first sight pass for evident and acknowledged defects.

That peculiar deficiency in the colouring matter under the epidermis, which in the holly still passes for a beauty, in the white mouse and rabbit already becomes a very doubtful merit; in the piebald peacock and in the horse only is tolerated, and in the human Albino,—in the white man devoid of all complexion, or in the spotted negro,—is considered as a positive deformity.

All such incidents as in living entities deserve the name of defects, are caused by a deficiency of the full complement of substances, forms and faculties, which were necessary to produce perfection.

This may at first sight seem a paradox. What! is a calf with two heads on one body, a human being with two thumbs on one hand, defective from not having of peculiar limbs or features a sufficiency? was Lambert deficient in having too little embonpoint?

The individual may have more than enough; but the species has not individuals enough distinct from each other to receive all the limbs which have been created.

What the defective or monstrous individual seems to have received in addition to his due, he has only received by employing part of what was due to another distinct individual, who by that means has been left incomplete.

If a flower has more petals, a fruit a greater size, an animal more limbs than in each species

belong to its several individuals, this only arises from substances having been employed in these supernumerary parts, which ought to have been employed in forming certain of the parts necessary to other individuals, which for want of them have not been achieved. An animal with two heads only arises from the attempt to form two individuals distinct and separate from each other having been begun, and having failed in the completion.

CHAPTER XIV.

What is it that distinguishes from entities, organic and living, called mere vegetables, those that are called animals?

WHAT is it, I say, that from those entities, organic and living, called mere vegetables, again distinguishes those that are called animals?

Is it the faculty of arising unattached to, or of becoming detached from, any other solid body, insentient or inorganic, different from themselves?

No, for on the one hand, already many mere vegetables possess this faculty. It exists in the Chinese air plant, which can live and grow between heaven and earth, unattached to, unconnected with, any other solid body. It exists in the conferva, which to the last floats, unattached, on the liquid expanse of the waters.

It exists in the seeds of all plants that first begin in the form of a cotyledon, detached from surrounding solid bodies, even vegetable and their own parents. It even exists in those mere mineral concretions, that, without rising out of prior solid matrices, like snow spangles, like

pyrites, like salt pillars, are, without any prior solid matrix as their medium, immediately formed in atmospheric gases or in terrestrial fluids. Nay, this faculty must already have been shown by the first solid substance in which began our globe, when, without the medium of any prior solid, it was seen in the midst of more extensive surrounding masses of mere water or air to arise and to consolidate. On the other hand, many animals do not yet possess this faculty. Many of the zoophyte species to the last remain connected with the insentient and inorganic rock on which they first arise.

Is it the faculty of organization, of life, and of growth which distinguishes animals from mere vegetables? No, certainly: for vegetables, in order to have a claim to that appellation, must already have organization, life and growth; and animals themselves, or at least entities destined to become such, have not yet this faculty of life in the first stage of their formation: since life is a phenomenon which depends on successive periods of time.

Is it the power of locomotion? If we mean that locomotion which arises merely from not being attached to the soil; not being anchored fast to a peculiar spot—from being, on the contrary, at the mercy of every external impulse, and the sport of winds and waves, it is not that. —Already many vegetables, like confervæ, de-

prived of roots that can rivet them to the solid earth, and only loosely floating on the yielding waters, already are in that predicament. If, on the contrary, we mean that locomotion which arises from an internal voluntary impulse, many animals, such as the zoophyte growing out of the solid rock, and such as the mollusca even, which subsequent ropes tie for ever to that rock, possess it not.

Is it in a form external or internal entirely different from those shown by mere vegetables? Is it in having externally, in a longitudinal direction, one way a head and the other a tail, and in a latitudinal direction, transverse to the former, both right and left lateral corresponding limbs: in having internally a cavity called stomach, through which passes a great portion of its nutriment?

Alas, no: for though as far as I know, of insentient entities—of mere vegetables—none yet pretend to the honour of a stomach, the privilege of possessing that cavity is not given to all sentient entities, to all animals, without exception. Zoophytes have externally no head, no tail, no side limbs. Internally they have not yet a pretence to a stomach. Like plants, many of these simplest of animals only push forth from their base an indefinite number of stems: only ramify in desultory branches: only feed upon mere fluids which they take in through their ex-

ternal pores: they might only be taken for vegetables, but that they cringe to the touch.

It is not even the intrinsic nature of their component substances that constitutes them animals. Certain vegetables already have a certain portion of all the visible elements of which animals are still fundamentally composed, and all animals still to the last possess a certain portion of the elements of which the simplest vegetables already require a portion.

What thus universally distinguishes all animals from all mere vegetables? It is only as far as we can see, the faculty of showing in their first and most fundamental solid organs, though themselves yet deprived of powers of sensation, a capacity to superstruct on these other later and more complex organs, which at a certain degree of maturity, and under certain peculiar circumstances, evince such powers of sensation, never acquired by mere vegetables.

I say, a capacity, for not only in most animals the first and most fundamental organs themselves do not yet evince any actual intrinsic powers of sensation: but even those later, more partial and more complex organs, afterwards superstructed on the first and most fundamental ones, that by degrees begin to show such powers, do not yet do so from the first, nor even, when they begin to show such powers, can they do so except under peculiar external circumstances: nor do, even

under these circumstances, the powers of feeling last without interruption. Other external circumstances, such as that of sleep and swoon, often interrupt their continuance: death puts on them a complete extinguisher. Yet by the custom of language, the first and most fundamental of organs of an entity in which is capable of arising any sensation, are already called those of an animal, and the last and most superficial of shapes in which any of these organs continue to be recognised, even after death, still bears the name of the organs of an animal. We call wool and feathers, even when collected in a pillow, animal substances.

As to what sensations themselves are, this I shall endeavour to explain more fully at a future period, and where they come into actual play. The word is sufficiently understood for my present purpose.

Now, whence comes it that, on the one hand, certain entities first formed as mere vegetables, never by further additions of new substances—by new further developments—can be made to rise to the rank of animals—can be made to acquire organs of sensation, and that, on the other hand, other entities seem, from their very first formation, intended to become animals? Is it from the latter being entirely formed of substances different from those of which are composed the former?

No; for we still find sentient entities all fundamentally formed of the very same substances of which already are formed organized entities not sentient. Certain mere vegetables, such as the acrid cruciform already possessing even of nitrogen—that substance regarded as most prominent in animals—a quantity nearly approaching that in which it is found in many animals.

Still is already nitrogen from the very first found in the composition of all animals, in greater quantity than it is found in that of any vegetables; and there may, besides nitrogen, exist certain substances not found at all in vegetables, but necessary to the composition of animals, which to this day have escaped detection.

It seems thus fair to suppose that, while mere vegetables are from the first only composed of substances of such a nature and in such relative proportions, as when solidified, offer not yet elasticity sufficient to permit the addition of those other substances which alone can form organs of sensation, the very first elements of which are composed animated forms, already, from the greater number and variety of substances, or the greater proportion of certain of the substances, of which they are composed, allow, when solidified, of showing that greater openness, those interstices more varied intervening between their solid parietes, that superior elasticity, necessary to admit of the later superstructure on them of those other organs in which

alone inhere immediate faculties of sensation: that the first and most fundamental saps formed in the very cotyledon, ovum, or placenta of an animal, and of which the part, by the pressure of the centrifugal force from without made to ascend, mixes with new aerial particles in the compound again redescending called lymph, and the other part, by the pressure of the centripetal force from without made to descend, mixes with new terrestrial or aqueous particles in the compound again reascending called chyle, already, by containing more nitrogen than mere vegetable saps of any sort contain, cause the first difference, and lay the foundation of the future greater ones, which distinguish mere vegetables from animals —that only from the peculiar nature of those saps called lymph and chyle proceeds their later remixture with each other in a tertiary sort of fluid, not possessed by mere vegetables, called blood, which, composed of portions of lymph and chyle mixed, does not yet in the earliest and simplest of animals in which it is found, yet differ much, either in substance or in colour, from either of the two fluids of whose mixture it is formed, taken singly and separately.

I do not mean to say or to imply that we can by this explanation be made to understand why and how these same substances in which, when mixed in certain proportions arises no power of sensation, when mixed in other different proportions and dispositions, rendering their mixture

more elastic, arises such a power. Whence arises in matter the capability of acquiring, under certain combinations, powers of sensation, not acquired by it under others. This circumstance must still remain among the secrets of Providence concealed in the first unknown attributes of matter. I only mean to state by what media such an event as the possessing the faculty of sensation is directly brought about.

After describing somewhat more circumstantially the nature and movements of the blood, I shall hastily survey the new forms, still insentient, in which the new proportions of certain substances may make them develope in those entities collectively called sentient, before I pass over to the organs of direct sensation, again on these organs themselves still insentient in their turn superstructed.

We shall see that while there are entities in which a substructure of organs still insentient, very simple and restricted, already suffices to bear a superstructure of certain organs sensitive, and even probably intellectual, other entities, like man, have a substructure of organs insensitive, very wide and complex, before on these again arises a superstructure of organs sensitive and intellectual; but in these more complex entities the latter sort of organs, founded on a broader base, itself becomes more varied and developed.

CHAPTER XV.

Blood; its component substances, forms and movements.

THAT in every animal only of the first and most fundamental fluid, itself half of elements from air descending, and half of elements from earth ascending composed, and of that animal forming the first solid parts cotyledinous, cellular and vascular, a part again, by centrifugal gravitation driven upward, was, with fresh elements descending from air, combined in that secondary fluid called lymph, and another part again, by centripetal gravitation driven downwards, was, with fresh elements ascending from earth, combined in that other secondary fluid, different from the former, called chyle: and that of this lymph and of this chyle portions again being made to meet, were combined together in that compound of tertiary formation called blood, appears from the relative order of birth of each of those fluids; and from the later ones being each composed of elements of the two former. Precisely however, because the chyliferous and lymphatic cells and vessels lie deeper than the

blood vessels, do these latter, when inflamed, conceal and eclipse the former. Of the blood itself the arterial sort is again composed of a part of that called veinous, again driven upwards and outwards, and again mixed with new elements flowing in from air, as appears since, while veinous blood often is found in animals without arterial blood, arterial blood never is found in animals, except prior veinous blood already had been formed and made to supply part of its elements.

At the same time, however, though in every entity organic and living we call every fluid, following the same order of formation, by the same name, it is to be observed, that in every entity organic and living generically different from another, the very first as well as each later species of component element, force, substance, proportion, form and movement, radiant, gaseous, fluid and solid, must already in some particulars be generically different from the substances bearing the same name in each other different genus, however much they may still bear the same name: since it is only out of their first generic difference in these respects, that arise all their later generic differences.

Thus already in every animal generically different from another animal, the first and most fundamental fluid, composed of elements half aerial and half aqueous, which afterwards again,

by new remixtures different from each other, separates and becomes half lymph and half chyle; and the later blood again, of part of this lymph and of part of this chyle in its turn formed; and of this very blood, the part that remains veinous, and the part that again by fresh remixtures with air becomes arterial, must each already be formed of substances in their nature, or at least, in their relative proportions, different from those of which they were formed in this other animal.

And that this is actually the case, we see, since the very lymph, or chyle, or blood of some animals, already acts as a poison on other animals of very different genera.

The same again remains the case with all the later fluids, such as bile, saliva, &c. again in their turn more lately formed partly out of the blood.

Veinous blood itself—the first fluid which bears the name of blood—seems already formed of the mixture of many substances, supplied by the lymph and chyle: some of these are already separately in this very fluid consolidated in lesser solid forms, and, while the others remain fluid, float in their mass, and by it are carried on, till they are again by surrounding pressures made to cohere in more considerable aggregates.

The serum, one of the two most fundamental constituent part of the blood, is supplied by the chyle. The fibrine, which forms its other constituent part, is supplied by the lymph. This

latter is consolidated in globules which continue floating in the serum, till again by it given off, and made further to cohere into muscle.

It has been asserted that in an animal, from the first moment it acquires any blood, this blood begins to circulate: that is, to move forward, till, having described a complete circle, less or more extensive, it again ends its course where it first began that course.

This I greatly doubt.

Firstly, there is no precedent for such a circulation in any of the earlier fluids in nature, which seem to have a similar origin, and to serve for similar purposes of successive increase and development.

All these fluids not only, as far as we can see, begin in something earlier and simpler than themselves, and are made to move forward, not merely in order to circulate to no purpose, so as again to end where they began, but on the contrary in order to combine in their progress in something again later and more complex than themselves.

This already is the case with the earliest, most simple and most universal of forces and substances which we know. If gravitation, if electricity, if cold and heat, light and colours, and other forces and substances, even still only radiant, move and advance—if from general space they enter certain bodies, it is only in order in

those bodies to become in part more condensed, to assume in them a new form, to undergo a new combination, to acquire new faculties, and to serve for new purposes. If from any peculiar body they again in part emanate, it is in order again to produce the same phenomena in other and different bodies.

If on this globe in particular we see in its first and most fundamental and most general element no longer merely radiant or gaseous,—in that water, its first most general circulating medium, menstruum and blood,—a constant movement from air downward to earth, and from earth again upward into air, this is not a mere circulation. At every step of its progress, at every stage of its journey, this water is still, on the one hand, by new accessions from air itself, fed, supplied, kept up and renovated, and, on the other hand, by new consolidations in solid bodies mineral, vegetable and animal, carried off: so as to render what at last returns to air, different from that which was first yielded by air, and having passed through different intervening processes.

It is the same with all earthly fluids, mineral, vegetable and animal, again more late and partial than mere water, and still earlier and more general than blood. All these, whether mineral fluids, vegetable saps, or the lymph and chyle of animals, in their course, give of certain of their former parts, and have their quantity kept up by new

parts, from simpler elements again added: and this cannot be called a complete circulation, by which again must be given up, in statu quo, all the materials furnished.

Secondly, such a complete circulation could have no object, could serve no purpose. It could only at the end of its course have matters restored as they were at the beginning: whereas blood in its movements is intended to take in elements by former fluids supplied it; to give off other elements by it carried along, in order to have these assimilated with the solids that want such for their support; to take in other elements already solidified, which again become fluidised and superfluous; to expel these from the body; and in all its movements to perform some purpose of nutrition, renovation, or ejection.

Thirdly, such circulation is not even confirmed, but is contradicted by the very inspection of the blood itself.

In the ova of animals the existence of blood first begins in different disconnected points. It forms different disconnected vessels. In its first stages it can only in these vessels necessarily make a short and partial progress, before its course is again stopped, even where afterwards it might, by the more generally increasing connexion of these vessels, acquire the means of the most perfect circulation. It can thus never in its first stage show that circulation. In many

simpler animals it never even attains the faculty of performing a complete circle, nor even in those in which it later attains this faculty, does it, in the natural state of the body, exert it.

If in higher animals, at a later period of their development, when any vein or artery is punctured, the blood ceases not flowing out, as long as any blood is left in the body, even this does not prove that in its natural state, every part of the blood that was at one time in one part of that body necessarily in its turn does and must visit every other part: it only proves that by the providence of nature, if any part wants its natural supply, it can, by participating in the supply yielded by another different part, be provided. Of what use, if naturally each particle of blood visited every part of the body in turns, would be local bleeding?

Blood in higher animals only appears to offer the complete circulation which it naturally performs not, because, as in all liquids, no line can be drawn between that part which is added, that which remains, and that which is given off, in each peculiar part of the body, and because the substance, form and colour of each part of the blood, to the sense, still resembles that of every other.

Blood, however, must in its course ever remain subject to be changed, given off, and replaced by fresh blood; and as such, cannot be

said necessarily and naturally to offer a complete circulation, which means, after a certain intervening portion of time, a return of certain elements, unchanged in quantity and in quality, to the identical place whence they first started.

In all animated entities, however, the blood, without ever naturally attaining a complete circulation, soon naturally acquires two different movements. The one is an advancing movement from one place to another, produced in the blood by the earlier pressure of the elements that form and that supply it, and which enable it in its turn to deposit in different places some portion of its own substance, to convert this substance from fluid into solid, to take up in its way other substances again from solid converted into fluid, to eject them, and thus to forward the functions of life, growth, elimination, renovation and gradual decay.

The other movement of blood, and which causes the former progress itself to be carried on with greater vigour, is, if I may so call it, a stationary movement—a movement on a pivot of its own. It is the continuation and development of that movement which already is exhibited in the tides of the sea. It is that movement caused by the pressure of the atmosphere without on the blood vessels within, which makes them contract, till, by their very contraction acquiring more power of resisting and counteracting it, they

again dilate, expand, in expanding weaken in their resistance, in the same proportion that air without, contracting, becomes stronger in its pressure, and thereby become exposed to fresh contraction. This movement, called pulsation, already in a certain degree existing in all bodies of an elastic sort, especially in vessels possessed within of a considerable void, becomes more sensible as these vessels become more elastic.

As to the red colour, it only begins in the blood of higher animals: and as to the sensible heat, it only, as in the other fluids of organized animals, increases in their blood in proportion as vitality becomes more active.

I have said that in many inferior animals the blood remains to the last entirely veinous: and already of the veinous blood a portion again discharges part of the carbon it took in from without, through the lymph, in the shape of that fluid called bile, which forms the liver, and is in part again discharged through that liver.

In higher animals, of the veinous blood driven upwards and outwards, a part is again made, by the pressure of external air against its carbon, to form a part of this carbon into tracheæ, and through these tracheæ to discharge another part of the same into air, while from that air it again takes in part of its oxygen. This new mixture is, by the continuation of the same pressure from without that formed it, made through the same

tracheæ to re-enter and redescend in the system, under the name of arterial blood.

At last, of the blood both arterial and veinous, of which a part has served to renovate and increase the body, the superfluous residue is again driven outward, and in its exit made to form the vessels called capillary. Never through these capillary vessels does it re-enter the system, except in such cases of inflammation as cause a rupture in the parietes that separate these last of vessels, called capillary, from those called chylific and lymphatic, through which the elements of blood first enter that system. Regularly the residue of the blood is again through these capillary vessels, and through the orifices or pores which terminate them, re-exhaled into that atmosphere from whence its elements first came.

CHAPTER XVI.

Glands and tracheæ.

When substances from without an organic and living body flowing inward, are in that body met by obstructions from within, which of these substances arrest a part, this part from fluid is first condensed into a cellular solid called gland, of which gland parts are again, by the fluid continuing to flow in them, moulded into vessels, and through these vessels the remainder of that fluid from without is again driven inward.

When saps from within an inorganic and living body flowing outward, are in their way out met by obstructions from without, in the shape of fresh aerial elements coming in, they are, from fluid as they were, with part of these new elements round the column they form condensed in a cellular tube called trachea, of which parts are again, by the fluid continuing from without to flow in them, converted into vessels, and through these vessels part of this fluid from without is again driven inward.

The solid gland is a mere secretory and excretory organ, but the hollow trachea, in its

earliest parts an excretory organ and spiraculum, also in its later parts and offices becomes an inhaling organ.

Such organs are in vegetables the roots through which of the fluids going out downwards a part, again by new aqueous elements from the earth underneath ascending arrested, is with these recombined, and again by them driven inwards and upwards.

Such are in vegetables the leaves through which of the fluids going out upwards a part, again by new aerial elements from the atmosphere above descending arrested, is with these recombined, and again by them driven inwards and downwards.

Such, lastly, are in vegetables the organs formed by the saps vertically ascending and descending which, meeting and arresting each other, between the former opposite vessels form new parts cellular and vascular, through which the residue of those two saps united in them is again carried out in a transverse and horizontal direction.

In animals the lymph and the chyle, through the lymphatics and chylifics running inwards, are made by their meeting to form glands, in which their different natures blend and combine in blood, first veinous, which again runs out of them, and again experiences fresh decombinations and recombinations.

When of that blood, at first all veinous, a part again in the body meets with a resistance that makes it throw off its carbon, in the shape of a fluid called bile, it solidifies part of that fluid in a gland first cellular, and next endowed with vessels, called liver, through which the remainder of the bile formed is vented and made to run on.

When of that blood, first all veinous, a part, again carried upwards and outwards, again meets with outer air, of its carbon a part is again by the resistance of that outer air round a column formed by the rest made to consolidate in the shape of a trachea, through which the remainder of that superfluous carbon flows out, and oxygen from without flows in, and with the residuum of the veinous blood combines in an arterial shape, in which it is again driven into the body: and the alternate periods of emission of the carbon from within, and of the introsusception of oxygen from without, are those called of exhalation and of inhalation.

The tracheæ and spiracula by degrees grow into features and limbs: some at last, by their growth from within choked, have their hollows filled up, their apertures obliterated: others on the contrary are, by the increasing pressure from without, and by the elongation from within, made by degrees to acquire deeper cavities and wider orifices.

Such are those called stomach, through which

are taken in new quantities of aqueous food, and those called broncheæ, through which are taken in new quantities of aerial food. These stomachs, when they elongate anteriorly, have their later elongation and more external outlet called throat and mouth; and when they elongate posteriorly, have their later elongation and more external outlet called bowels and anus: and these broncheæ, when they elongate anteriorly, have their earlier and more interior parts called lungs, and their later and more external elongations and outlets called Eustachian tubes and ears. In animals higher and more complex, these tubes become partly choked up and closed, and force the aerial elements from the lungs to go out of, and the aerial elements from without to flow in, through the duct of the throat, and the passage of the mouth or nostrils; and leave the ears merely subservient to the purpose of affording a seat to the organs of hearing.

As animals are first formed in water, in air or between these two elements, the pressure from without upon their tracheæ, and the counter-pressure from these tracheæ again outward, makes these channels become deeper and longer. In fish they extend inward into air bladders, and in birds even into the very tubes that penetrate in the feathers: and these ramifications of aerial elements lighten the animal in the fluid in which it moves.

In quadrupeds a further stoppage of the nitrogen produces the glands called kidneys, and the fluid which again escapes from these glands in the shape of urine.

Of the tracheæ and spiracula the channels and orifices are ever lined with a part of the fluid exsuding from them, which is called mucus.

CHAPTER XVII.

Most animals still have a considerable substructure of organs and parts vital merely insentient, before on these they again superstruct parts of a sentient nature.

For reasons of which we feel not yet the full cogency, except that it could not be otherwise in the mechanism of this world, many animals, and those especially of the higher order, have yet their organs of a sentient sort—the first on which depends with their feeling their felicity—only superstructed on an immense base or scaffolding of organs of vitality, wholly insentient, which precede and support them; and of which I shall here give a sketch, before I pass over to those of a sentient description.

I shall however caution my reader that of these mere vital developments and changes many already take place while the animal still lies in the concealment and under the cover of the ovum;—nay, while these developments still remain to us liquid:—before they yet acquire that consistency which enables them to become distinguishable to our sense; and especially before they are disclosed to the eye, by that maturity

which makes them cast off the egg-shell: and I shall add, that the more complex the animal becomes, the more numerous and varied are the changes and developments by reciprocal pressures and counterpressures produced, which thus take place, and wholly change the appearance of the animal, before it is permitted to issue forth from the ovum; and of which, consequently, when it starts forth into day-light, the commencement and the progress are already past watching.

The earliest and simplest of entities which to their forms merely vital seem to add forms sentient, seem still to retain vital forms entirely similar to those of the organised entities that have none other. Of the entities that under the name of zoophytes still, like mere vegetables, through their external pores alone, carry on all the processes of vitality—absorb from without all the nutriment they want, and again emanate outward of that nutriment all the superfluities:—none yet appear to have any internal cavity called stomach, nor any external protuberance called head. Rooted in the ground, and deprived of powers of voluntary locomotion, they might still be mistaken for mere vegetables, did they not seem to possess powers of feeling, and when grasped, to shrink from the touch.

But next to those simplest of animals are seen to rise others, already formed of substances whose relative proportions render them so much more

elastic, so much more yielding to pressure from without and to suction from within, that by these they are soon made to receive, in addition to their external surface, an internal dip, or dent, or infolding of that surface, which, as it elongates inwards, becomes a bag, a stomach; and in this stomach, of the exsudations from within the body, before confined to the external surface, a part now also again re-issues outward under the name, no longer of mere transpiration, but of gastric juice.

When, afterwards, the first organs of feeling begin to experience the want of taking into this stomach external substances of the same sort, but more substantial than those that can be taken in through the mere external pores, and cause the orifice of this stomach, called mouth, to expand over these external substances, to cling round them, and to take them in, the gastric juice collecting in its deeper internal void dissolves these, and renders the part of them wanted within, capable of being by the pores of this cavity absorbed: while the superfluous part is again by pressure from within against the coats of this stomach repelled outward, and made to be thrown up through the same orifice through which they were first taken in; and which, consequently, after having first served as mouth, now serves as its reverse.

Most animals of this sort are, from the more substantial food they gradually take in, made from within the coats of that stomach or mouth to protrude and to elongate outwards around its edge in certain tracheæ which, under the name of tentaculæ, feelers, fingers, or feet, serve to draw them closer to the external objects that have excited their concupiscence, to cling round them, and to press them in their stomachs: and which thus stand them in lieu of feet, of fingers and of tongue more distinct and elaborate.

In other animals, composed of molecules wove together in forms still more elastic and yielding, the cavity of the stomach is pressed downward and perforated into an entire tube, with a second issue opposite that from on high, which latter faces the earth; and when food is taken in through the former, and is in the cavity of the stomach through the gastric juice from its surrounding parietes flowing into the same, decombined and dissolved, and when the nutritive part of that food, by the pores of that stomach absorbed, the superfluous residuum is left to sink to this lower orifice, and is there driven out.

I have already stated how, in animals, of the external elements taken in at the external pores of the body, the part taken in from the atmosphere is called lymph, and the part taken in from the earth is called chyle, and how, in ani-

mals, of part of these different external fluids taken in, the later remixture inside the body into a new compound is called veinous blood.

With these external elements taken in at the internal pores of the stomach the same is the case. One half derived from on high forms lymph, and the other half derived from underneath turns to chyle—namely, lymph and chyle. The two different fluids, which also are remixed in blood, are, however, little distinguishable, and are all driven to a common place of rendezvous, or reservoir, called thoracic duct, where they are first mixed in the shape of blood.

As I observed before, of the veinous blood, partly nearer the external surface, and partly in this thoracic duct formed, a part, driven downwards, is made again to discharge the carbon it took in from air through the lymph in the form of bile; of which bile, a part consolidates in the liver, and another part is again by that organ vented and made to flow further on.

Of the veinous blood another part again driven out upward, is again made to discharge its carbon in outer air, and from that outer air to take in finer aerial elements, such as oxygen, in greater quantities, and with these again by the pressure of air from without to be driven downwards and inwards, in the new shape of arterial blood.

I shall add, that in proportion as water, land

or air are in a greater degree the first cradle of the deposits whose meeting first forms animals, these animals are not only made first to receive particles aqueous and aerial, but next, to want of these for their further support and growth, fresh supplies in relative proportions equally different.

Already mere vegetables from the substances which they take in from air, again drive out a part which, round their more early and fundamental organs, consolidates and crystallizes under the name of wood, and gives these earlier parts, with more firmness and more strength, more ability to perform their various functions.

Animals in the same way again drive out part of the fibrine, taken in through the lymph, through the medium of the blood, and again in the lost corners of the frame, where they are left to collect, consolidate and crystallize these portions of fibrine under the name of muscle, of which the texture preserves great elasticity and susceptibility to be by the pressure of air, and the resistance it offers to that pressure when carried beyond a certain length, alternately contracted and expanded, and of thus communicating that motion called pulsation, from external air received, to the more internal vessels round which the muscle is formed. Thus is communicated to those vessels and to the fluid contained within them, the movement of pulsation, and its effect on fluids. This pulsation, where muscle

becomes more directly exposed to outer air, becomes palpitation; and when muscles become affected by the later fluid from within which causes the sensations of will, their elasticity powerfully assists the contractions by that fluid occasioned in them.

Of this muscle, the portions situated round the principal blood-vessels, both veinous and arterial, by degrees become what are called hearts.

In all animals, from the stomach and the tracheæ, which are more early and fundamental parts,—the one sort in greater proportion formed out of the elements from earth ascending, and the other sort in greater proportion formed out of the elements from the atmosphere descending,—are, by the pressure from without inwards being made to recoil outwards, made to form and to elongate outward, first one way, and anteriorly, the throat and orifice called mouth, and the other and opposite way, and posteriorly, the bowels and inferior orifice.

And from the counterpressure which these elongations anterior are again made to receive from without, are again made to arise the lateral pressures outward, anterior, which form the tracheæ and the elongations which end in the anterior side limbs; while from the counterpressure which these elongations posterior are again made to receive from without, are again made to arise the lateral posterior pressures out-

ward, which form the tracheæ and the elongations ending in the posterior side limbs.

I have, however, already observed, and I here again repeat, that according as animals are first formed in an element denser or lighter—are first formed in water, on land, or in air—and thus continue ever afterwards through the less or greater elasticity of their component solids to receive a pressure and influx of further elements from without inward, less or more copious and rapid, this pressure and influx from without inward of a centripetal nature less or more forcible, when, in its shock with that coming in from the opposite side it is made again to recoil outward and to produce a force, movement and afflux in a centrifugal direction, also again in its turn cause a centrifugal pressure and movement outwards less or greater; and thereby causes the animal by degrees from his more early and central parts to push and put forth outward features and limbs, offering a less or a greater elongation outward, and again, by a counterpressure from without more forcible and more subdivided, ramifying further outward more curiously and minutely.

This we find to be the case.

In the animals lower or higher—endued with fewer or more internal parts, still first formed and continuing to develope in that denser element water, when they first out of their funda-

mental cotyledon, seed, placenta or ovum, develope in the later parts proper, whether it be of mere mollusca, of fishes, or even of cetaceæ, still out of their different tracheæ elongating outward form no projections, no features, no limbs, advancing beyond the general outline of the animal. Oysters have not yet any distinct external features or limbs. Even the fish of the deeper waters still have no face. The extremities of their most prominent tracheæ still lie close to their bellies. The very highest of these entities can still hardly be said to have a head wholly distinct from the body. The same is the case with their tail: and their lateral limbs do not yet peep forth beyond the general integument of the skin. At most through this skin flow out those exsudations that consolidate in fins. All their external parts are still smooth and slippery: they become not covered with that down, that fur, those feathers that only grow on animals more aerial.

In amphibia the development of the limbs already is greater: still greater is that in animals first formed between earth and air, and it is greatest of all in those that, like insects and birds, are formed in purest air.

In these later animals the tracheæ and spiracula, by the centrifugal force formed, grow more into features and limbs, in extremities anterior, posterior and lateral very elongated. They have a head very distinct, and in that head the fluids

exhaling from within are with new increments from without made to form excrescences of different sorts—proboscis, antennæ, eyes, &c.—very developed. In the body likewise the fluids exhaling with new increments from without, are formed into wings very wide and legs very long. These parts again in their turn become covered by a thick tissue of down, hair or feathers.

Nay, those animals that, first formed in the denser element, by the rapidity with which they inhale and feed on its grosser elements, soon find themselves capable of rising to a higher abode, also soon exchange their sleeker and smoother exterior for the parts more projecting, in their new abode wanted, and by their new abode produced.

Of element, from external air first through the pores of the skin inhaled, condensed into lymph, and through the body circulated, while a part is with chyle combined into blood, another part is again through the coats of the stomach exsuded under the name of gastric juice; and another part is again later through the later and higher coats of the throat and mouth exsuded under the name of saliva. When afterwards the animal is launched into outer air, and these juices become more abundant, of the food sucked in at the mouth the saliva begins, and the gastric juice completes the decombination, ere of this food part be by the coats of the stomach absorbed, and made to enter the system.

CHAPTER XVIII.

In proportion as of organic entities the first solids are by their greater elasticity suffered to absorb later succeeding elements, with more ease and in greater quantities, these later elements of each sort are also left to remain less divided, dispersed, weak and resisted, and are made on the contrary with these former aggregates to compose later solid aggregates more united, more forcible, more pressing upon other different neighbouring aggregates equally forcible with themselves, and are also more in their turn by these other neighbouring aggregates pressed upon.

In the earliest and simplest of entities in which appears an organ of any peculiar sort, of that organ the materials and molecules, still only finding in that entity less elasticity, less readiness to receive them, still only enter in portions very minute, very much resisted and divided by the solids already formed. They still only in that entity of that new organ form at great distances specimens very small, very weak, very much divided, very numerous and very inefficient: they press little upon their neigh-

bours, and are by these neighbours greatly resisted.

As organized entities in their first foundation are higher, more complex, and more elastic, they offer in them room and means to receive the new elements capable of forming in them these new organs in quantities less divided, less dispersed, less weak, larger, more condensed, more collected in a single spot, more possessing the faculty of pressing forcibly on other neighbouring organs, and more liable also in their turn to receive from their neighbours a counter-pressure equally undivided and forcible.

This already is seen in the earliest organs of mere vegetables. Their tracheæ downward, which, with aqueous elements from underneath rising, are fed and formed into roots, and their other tracheæ upwards, which, with aerial elements from on high descending, are fed and formed into leaves, still are seen each to increase in indefinite numbers, but to remain individually very small and weak.

Even in entities of a sentient sort most simple—in those that, under the name of zoophytes, still in their growth resemble mere vegetables most,—this still is the case. Their roots, their branches, their stems, their spiracula still often are in indefinite numbers, but individually very weak and inefficient.

Nay, in mere vegetables, the higher and later

parts of which we shall speak afterwards—their flowers and their fruits,—still arise in indefinite numbers.

In all entities that, out of the mixture of part of their chyle with part of their lymph, acquire any blood, and any vessels conveying such blood along, these vessels are first only made to arise on points divided and separate from each other. In many inferior animals these veins never afterwards are made to communicate. It is only in higher entities, that by a pressure more forcible and general, they are by degrees made to run together.

Of the blood, at first all veinous, portions again from within driven outwards are, in simpler animals, only made to exhale their carbon in outer air, and from outer air to take in fresh oxygen, in tracheæ still very small, very numerous, very widely dispersed through the system; but still individually very weak and very inefficient.

Only in higher animals, of these tracheæ a certain number are compressed together and made to unite in fewer and more capacious bronchiæ; and of these bronchiæ again the channels by further elongation outward grow deeper inwards, and give the earlier and more internal fundamental parts more the character of lungs.

In the simplest animals in which from the elements, exsuded by the blood veinous and

arterial, is formed any muscle, this muscle still is lax, loose and little close and compressed. As by vessels more numerous more muscle is exsuded, its mass becomes more close and compressed. In the simplest animals in which any muscle is visible, none of that muscle yet assumes the decided character of heart.

In the animals least complex in which any muscle already acts in the capacity of heart veinous and arterial, there are many such hearts widely separated from each other, but each yet little active, little defined, and only keeping up a low pulsation. In animals more complex the materials of all these hearts are compressed in only two organs of pulsation very powerful, one veinous and the other arterial, which again are huddled close together in a single aggregate.

It fares the same in animals with the organs sensitive, intellectual and reactive, again superstructed on the mere vital organs.

In the simplest animals receiving any sensations, the organs of all these sensations, even that of sight, still are dispersed throughout the whole body. They have not yet any peculiar locality which we can discern. The polypus seems in every part equally sensible to light.

In animals more complex the organs of sight—the pupils of the eye though driven exclusively to the head, still are in great numbers; they resemble a honey-comb.

In animals still more complex these pupils become restricted to a single pair.

The organs of intellect are likewise in lower animals divided among a number of smaller ganglia, dispersed all over the body. In animals more complex they are chiefly reduced to two larger lobes driven to the brain.

The very organs of voluntary action outwards have the same fate. In inferior animals they are extended over a long proboscis, and large antennæ. They are divided between many features, many limbs, each less defined in their use, less exclusively fitted for their purpose. In higher animals they are each reduced to the two halves of a single whole, or to a single pair. While the millepede has a thousand crawlers, man has only a single pair of hands and of feet.

It should even be observed that while a plant singly has a thousand different specimens of the organs of generation,—of fruits and of flowers;—each higher animal singly has only a single specimen of either or even a specimen only of one of the two It is only exclusively male or exclusively female. Of that we shall afterwards show the cause.

It must, however, be owned that if on the one hand the different organs of organic entities, when they are of this latter sort—when they are few but highly finished,—as long as they endure,

perform their office best, on the other hand when they are injured or destroyed, leave their loss least reparable.

That same greater activity and pressure of all the vital fluids which, while each continues to flow in its proper organs, continues to give each organ more swell, more elaborateness, more finish, when any organ is injured and lost, makes every neighbouring organ so much sooner invade its room, and occupy its elements still continuing to flow in, as to make them convert these elements sooner to their own use, and leave the organ lost a less chance of being replaced.

In a plant or zoophyte certain ramifications lopped off are little missed, and are easily restored. Such entities are not yet liable to curtailment or decapitation.

Of the polypus the external parts turned inward and the internal parts turned outward, each easily assume the functions and replaces the office of the other, and make the animal go on as before. In a worm or snail, when the head is cut off, out of the more central parts whence sprung forth the first head, a new head is soon again made to shoot forth; and that head, to have its sensitive and intellectual organs like the first.

Even a lobster and a crab still, on losing a limb, will have that limb speedily replaced.

But as soon as animals by the multiplicity of their first component parts, contending with each other for superiority, have become vertebral, and have had the locality of each later part so defined, that as soon as one organ is lost, all the other neighbouring ones vie to invade its site, and to absorb its nutriment, there only remains, where it is lost, room for the replacement of mere intervening expletives.

CHAPTER XIX.

A few presumptive proofs of certain of the foregoing statements.

Before I proceed further in my long-winded series of inductions, and begin upon the topic which comes next in the order of natural developments—that of the organs and faculties of sensation which arise out of the prior modifications of matter inorganic and organic,—let me here, respecting the origin and developments of that matter inorganic and organic still insentient, resume some of the former proofs, and adduce some further proofs, at least of a probable sort.

That from the first creation only out of opposite forces, from points of time earlier and from points of space more external and more distant made to converge inward to points of time nearer and to points of space more proximate, till by further pressure from behind, and by first meeting and resistance from before, they were again each made to recoil, to diverge, and in later time to recede further backward and to a greater distance from each other, arose all forces from a

more restricted inward centre radiating to more external and distant extremities, is a truth which appears evident, since to this day only, after forces have previously from without radiated inwards, and resisted each other, forces from within are again made to radiate outward, and to fly from each other.

That only where forces of gravitation, from centripetal made to become centrifugal, in their way outward are made again to meet with, and be resisted by later forces centripetal from without converging to that same centre, they are by pressure from behind and resistance from before, made, from their direction perpendicular to each other, to diverge right and left in a direction transverse to, and at right angles with the former, in which, advancing outward, they are made to cut across the remainder of these former, arises the new and more circumscribed force called of electricity, appears since, within forces of gravitation centripetal and centrifugal, forces of electricity arise later and more partially, and thus seem to arise out of nothing else prior and more external besides those forces of gravitation themselves; and since they still receive from behind, and give to entities before them pressures resembling those of gravitation, but moving in directions different from those of mere gravitation, either centripetal or centrifugal.

That only of forces of electricity from op-

posite points of space advancing to each other, so as to compress intervening forces between them, consists more proximately, and thus of forces of gravitation centripetal and centrifugal from opposite points of space advancing to each other consists more remotely the force called of cold, which compresses substances from radiant into gaseous liquid and solid, mineral, vegetable and animal, appears since all cold, and all combination of substances radiant in substances more solid, is preceded and accompanied by electricity.

That only out of other forces of electricity, after they have from outward and more distant opposite points of space so come in collision, as again from more internal and nearer points of space to be forced outward in a centrifugal direction, and to cause the substances, by the former electricity productive of cold compressed, again to be dilated, separated, and pushed asunder, arises the force giving the sensation of heat, and the decombinations and dissolutions of substances by that heat produced from a form solid into one liquid gaseous and radiant, appears since all dissolutions of substances more solid, into substances more attenuated, is likewise preceded and accompanied by electricity, but of a sort different from that productive of cold and combination.

That substances before radiant are, by the

force of electricity productive of cold, compressed in molecules separate from each other infinitely minute, before, by later forces of cold supervening, these molecules are again collected, compressed and combined together in later and larger solid and cohering bodies—that all cohesion of molecules in later and larger solid bodies, is only the effect of a relative arrangement of these molecules, by which arrangement they come in certain peculiar directions in greater contact, and thus in certain other directions return to greater separation from each other, and thus experience on different sides a pressure unequal and unbalanced, appears since molecules before gaseous, when from a state of mere collapsion and liquidity congealing into solid bodies, are again, in consequence of that more definite and peculiar relative disposition of their individual forms relative to each other, which they are made to assume, collectively also again made to occupy a somewhat wider space.

That molecules of substance, when by heat penetrated, are by its force distended and dilated, before they are entirely dissolved and made to separate and to lose all cohesion, appears since a piece of wrought iron, which, while by cold compressed, passes through a hole of a peculiar diameter, when become hot, no longer can be made to pass through the same aperture; and

since substances, by cold which diminishes the interstices between their molecules, rendered rigid, by heat which increases these interstices is again rendered pliant; and since the strings of a harp, tuned while the air of a room is cold, when, by the influx of company desirous of enjoying the music that air becomes heated, often again through the relaxation of its strings becomes untuned.

That it is not the different degrees or quantities of cold or of heat which are retained in different external substances or bodies, and which reach not our organs of sense, but those quantities of each which precisely again from these bodies issue and penetrate into our organs of sense, that we feel—that it is the different quantities in which, and the different degrees of rapidity with which, of the cold or heat contained in certain bodies a portion again issues from them, and enters these organs, that makes these bodies, on approximating or touching them, feel colder or hotter, appears since when barefooted and in the same general temperature we step successively upon substances like carpets, boards, bricks, stone and iron, each letting out a degree of cold, greater than the feet contain, with a different degree of rapidity, they will all alike still appear colder than these feet, till by letting out more of the cold contained in them into those

feet, and extracting and taking in more of the heat first contained in those feet, the whole of the heat and cold contained in each is so equalized and balanced, as no longer to let any from these external bodies or substances pass into the feet; and since both the cold of ice and the heat of iron fused may in each substance be preserved longer, and longer be prevented from all evaporating from it, from penetrating into the hand, and from being felt by the organs of touch, when that ice or that iron are enveloped in such another substance, placed between itself and that hand, as, like wool, is slower in conducting the cold or heat out of it into that hand; and since in the same way, in the human body, in winter the heat, and in summer the cold from within, may equally be longer prevented from going out through the medium of such an envelope, than without it.

That electricity combining and productive of cold from without only by keeping bodies vegetable and animal so compressed and condensed, as to keep later electricity from without of a decombining sort and productive of heat, incapable of penetrating into them, prevents them even when life has quitted them, from putrifying, appears since the moment they are again by heat so expanded as to thaw, they begin to putrify; unless that expansion should be so rapid and so great, as by combustion, explosion,

or detonation, again to dissolve them instantaneously, and not to leave time for the more gradual process of putrefaction.

That only as of the forces of gravitation and of electricity later portions are made to combine earlier portions in ways different from each other, they are made to combine these earlier portions in substances radiant, gaseous, liquid and solid, different in their nature from each other, appears since all substances are alike formed by electricity, and yet each different substance appears individually to present forces of electricity, modified and moving in quantities and directions different from the others.

That forces of electricity distant from each other, driven to molecules of substances so as to compress and interlock those substances, may produce alkalies, and that forces of electricity from amidst molecules of substances so driven out as partly again to press and drive these substances outward, may produce acids, may perhaps be inferred from the nature, astringent and contracting, of alkalies, and from the nature, dilating, decombining and producing effervescence, of acids.

That only forces of electricity of a combining sort, by finding in substances of different descriptions a resistance to them in different directions, causes these substances to be compressed in molecules of different shapes, appears since of

different substances the molecules, when combined together in larger bodies of a crystalline sort, produce bodies which, when composed of the same sort of substance, in their intrinsic shape, their external relative position, their interstices and their parietes, are always similar, and which, when on the contrary composed of sorts of substances different from each other, in their intrinsic shape and their external relative position, their interstices and their solids—in their collective forms in short—are always different.

That only by the compression of electricity, substances, first radiant and volatile, are rendered successively gaseous, liquid and solid or stationary, appears since in each of those successive later shapes, each portion of a peculiar substance, or each molecule, is driven to each neighbouring molecule more forcibly, closely, definitely and permanently.

That all collective aggregates of substances, from those still gaseous to those most cohering and solid, whether they only be destined to remain to the last inorganic, or whether they be calculated by degrees to become organic, are, from the peculiar shapes of their peculiar component molecules, first made in their condensation and cohesion into larger cohering solids to present a porous and cellular form, only composing a stratum, or layer, or follicle, or membrane extended in a flat and horizontal di-

rection, before this stratum is again by further pressure on its centre made to curve up at its extremities into the form of a cylinder or tube called vessel, appears since the gravitation centripetal and centrifugal acting from opposite sides on that electricity, by which this horizontal form is first produced and consolidated, must by their different opposite pressures subsequently give its productions that curve and converging; and since we see vascular concretions of all sorts only arise later and more partially out of earlier and more general prior horizontal cellular ones. Witness those arising in the cotyledon and egg.

That only, of bodies partly solid, at first inorganic, lifeless and unchanged, by certain new fluids from without penetrating and consolidating within their interstices, without wholly, by their later consolidation and swell, destroying the former consolidation, is first produced and further increased the growth, appears since only by new fluids continually penetrating and consolidating in former substances already solidified, these former solids, from smaller and lifeless, become larger and living.

That the difference, from solids remaining inorganic and lifeless, exhibited by solids become organic and living, only arises from the former solids being so consolidated as to admit of no fresh fluids admitted in them continuing to consoli-

date with them, but again issuing from them, or in them only remaining in their fluid state, or, if in them consolidating, only doing so at their expense, and in doing so dissolve and decombine these former solids themselves, and from the latter being so consolidated as to admit in them of fresh consolidations which destroy not wholly the prior ones, appears since only where substances become organic and living such new consolidations are superstructed within the former solids, as only extend and stretch, without wholly destroying, these former ones themselves.

That external forces and substances, such as cold and heat, air, moisture, and others, in quantities in which from without they penetrate unimpeded in bodies inorganic and lifeless, and either pass through them unarrested, or choke them up, or by their congelation so distend as to dissolve them, and as not to increase by their accession the size or faculties of these solid bodies, are by bodies organic and living, from the earliest and simplest, so resisted as with these to be combined in new quantities, fitted to increase their forms and to extend their faculties, and not to have by cessation of movement or of cohesion their life terminated: that if a body endowed with life can, through its greater heat from within, resist a cold from without, which, in one not living, by congealing every fluid, stops all internal circulation; or can through its

greater cold from within resist a heat from without, which, in one not living, by dissolving every solid, stops all internal circulation; that the electricity confined in a seed, an ovum, or any place deprived of thorough draft, resists alike that electricity from without which would in a place more exposed have caused either its further expansion or its extinction; that if in a live stomach the gastric juice exsuding from within, which would entirely have dissolved external bodies taken into that stomach, or have dissolved that stomach itself for want of such substances to protect it, after death has no power over these substances during life, and cannot kill any fruit or leaves wholly uninjured and intact harboured in that stomach; that if in a body, while living, the blood continues liquid and circulating, and in a dying body coagulates and stands still; that if by a body living, hale, and strong, influences and miasmata from abroad are resisted which overcome one in ill health, these are phenomena only arising from the faculty of life; only consisting in the solids of bodies being so disposed, with regard to the intervening pores, as, while suffering the penetration of new fluids in the quantities necessary to make these solids grow, to prevent their penetration in the quantities calculated to decombine and dissolve them, appears since, the moment by death solids are prevented from any longer arresting the entrance of

fluids in detrimental quantities, those that present themselves do enter in such injurious quantities as to take full possession of the body, and, finding it deprived of its ægis, from all sides to hasten its decomposition.

That of blood the molecules, which in a live body remain detached and fluid, in a body dying are left from the departure of the heat that kept them separate to coagulate and cohere, appears since if that body, struck by lightning, die of an excess of the electricity which produces heat, the blood will not in it coagulate.

That in organic and living bodies glands are only a tissue of parenchyma or cellular concretions, by prior fluids aggregated in such a way that later fluids of the same sort, driven to and made to enter them, are made in them to give off certain of their component elements, before the remainder are again through vessels formed of part of this parenchyma left to flow out, appears since fluids are seen when running into glands, to be composed of elements different from those of which they are composed when again running out of them.

That only out of a stratum of cellular organs curving till their extremities again join in a cylinder arise vascular organs, appears since vascular organs always arise out of prior mere cellular organs, and first begin to grow in grooves before they end in complete cylinders.

That in all bodies organic and living in which, on a first system of fluids and of solids cellular and vascular, are superstructed two systems of fluids and of solids, cellular and vascular, each different both from the first and from the other secondary system, this only arises from one part of the first fluids being driven upwards till pressed by and mixing with new elements descending from air, and another part of these first fluids being driven downwards till pressed by and mixing with new elements arising from earth, appears since only where these opposite determinations exist these formations of opposite solids arise out of the fluids driven forward by them; and since in vegetables in which the situation of the opposite vessels may be permanently reversed, in such a way that those which before faced the sky face the earth, and that those which first faced the earth face the heavens, foliage will spring forth upwards from where before roots grew downward, and roots will protrude downwards from where before leaves shot forth upwards: and if it should be observed that the new roots and new leaves do not always rise in a straight line with regard to each other—new roots under former roots and new leaves over former leaves,—this must be owing to that obliquity which the shape, extension and spread of their component molecules, when solidified, gives them.

Fix seeds on a wheel so that, by its rotation, their opposite sides shall each in turns face gravitation centripetal and centrifugal, and the leaves and roots both will be disturbed in their natural position, and puzzled which way to shoot forth.

That in organic and living bodies like vegetables it is only by fluids of the same sort, determined in the same direction, being from without arrested by and mixed with the same elements, that are made to arise on them and to cohere with them, new organs of the same sort—new leaves on former leaves and new roots in continuation of former roots—and that in organic and living bodies like animals it is only by fluids of the same sort, determined in the same direction, being from without arrested by and mixed with elements, different in their nature or in their proportions, that are made on former organs to arise and to cohere with them new organs of a different sort—organs sensitive on organs merely vital, and organs intellectual on organs merely sensitive, appears since in new organs of the same description superstructed on former ones, the elements from both sides still are of the same sort and in the same proportion, and since in new organs of different descriptions superstructed on former ones, the elements supplied from without always are different, or at least in different proportions.

That in animals only out of the meeting of

earlier lymph and chyle from without in different parts within arises the first blood, appears since in an incubated egg only on points distant from each other that blood first arises, and first partly consolidates in cells, and these cells first are aggregated in flat layers, strata or follicles, before they are next bent in grooves, and before these grooves again, by their extremities laterally returning to each other and joining, become complete cylinders or tubes, and before these cylinders or tubes endwise join and run into one.

That of blood the first sort, that which is formed immediately out of the mixture of lymph and chyle, is veinous: that veinous blood, and veins themselves, precede and are the foundation of arterial blood and arteries: that only out of the later emission of part of the carbon mixed in veinous blood into air, and introsusception of part of the oxygen mixed in air, by what remains of the veinous blood, are formed arterial blood and arteries, appears since on the one hand veinous blood and veins are found where no arterial blood and arteries exist, whereas, on the other hand, arterial blood and arteries only are found where veinous blood and veins have preceded them, and have only, by part of that veinous blood being again driven out of the system and made from within to give off some of its former elements into air, and the remaining part having from that air without been made to

take in some new elements, themselves been formed there. But that the blood arterial descending, in certain places again remixes with the veinous blood ascending, appears since even in the highest of animals the distinction between blood veinous and arterial is not from the first in the lungs rendered so complete, that there exists not between the two sorts of blood in the hearts veinous and arterial a communication, which afterwards is by the growth and extension of the heart's ventricles closed up, and leaves the two sorts of blood thenceforth throughout to flow entirely separate from each other.

That of the carbon by the lymph poured into the blood a part, again by obstructions in the body separated from that blood, composes the bile and solidifies in the liver, appears since blood is found to carry this carbon into the liver, and since out of that liver again flows separately one way the excess of that carbon in the shape of blood, and another way the residue of that blood, which forms and loses itself in the spleen: and since, as on the one hand animals acquire downwards greater livers, they on the other hand form upwards smaller lungs, and vice versâ.

That the lungs in the later parts proper of an animal formed, are not the only and first organ in which veinous blood is partly made to revert to air, and to be changed into arterial blood, appears since already in the cotyledon or placenta of higher animals itself, through certain earlier

tracheæ some veinous blood is changed into arterial blood, which afterwards through the umbilical cord is made to pass into the parts proper of the animal, and there to form the solid parts of an arterial nature, while yet the lungs, immersed in liquid, enter not fully upon their functions: and since during that period there remains between the veinous and arterial hearts, already formed, a communication more direct, which, when, by the opening of the lungs, the formation of arterial blood is circuitously more increased, is by the extension and growth of these hearts again closed.

That as from the stomach and lungs are, by gravitation centrifugal and diverging from the earth, made to grow upwards the throat and mouth and face and head, from that same stomach and lungs, are, by the recoil of that centrifugal gravitation in an opposite direction centripetal and converging to the earth, made to grow downwards the bowels and nether extremities, appears since the two systems of organs, upwards and downwards, taking in and letting out, always extend in opposite directions.

And that by the bile again from the liver flowing downward and again penetrating what elongations of the stomach in the shape of bowels were driven downwards, again lubricates these, and in them finishes the decombination of the food, and the separation of those substances fit for absorption and nutrition, from those only fit

for re-ejection, begun in the stomach, appears since, where this bile is not formed in sufficient quantities, the digestion goes on badly, and the body remains costive; whereas, when too much of this bile is formed and sent downwards, the body becomes relaxed.

That only where in an animal aggregate tracheæ had first appeared, a further elongation of these tracheæ outward produced broncheæ, and that only where broncheæ had first appeared, a still further elongation of them outwards causes the internal parts to be called lungs, and that in fishes and in birds it is the pressure of aerial elements from without, or suction of these elements from within, continued still further, which causes that air again to circulate outward till in the fish it forms an air bladder, and till in the bird it inflates the bones and the quills, appears by the relative order in time and in place in which, in successive stages of the formation of animal embrios, these different parts appear.

That far from hearts first causing in the veins or arteries the pulsation, and still less the circulation they manifest, the pulsation, was by the pressure of air from around already begun prior to the existence of hearts: that hearts only through their medium strengthen and increase these former pressures, appears since even vegetables, and animals having no hearts, such as insects, have a certain pulsation as well as motion of saps, and since even human beings have

been born, destitute of hearts, without being left wholly destitute of pulsation.

That where in an animal, in addition to an external surface, there is formed an internal surface called stomach, this latter is only a reduplication of the former: that only the different situation of each respecting external space and elements causes the difference of their functions, appears since in the polypus, in which the form of the other parts still permits the turning of the two opposite surfaces one inside out, and the other outside in, they soon exchange offices.

That in certain animals the inside cavity which grows into a stomach, arises not from a pressure which indents, penetrates, and, as it were, digs into the first mass longitudinally, but from a pressure which makes that mass, first stretched out like a leaf with two corresponding lobes, later again infold itself so as to make the edges of both sides, previously diverging from each other, latitudinally again converge to each other, meet, rejoin, and form an external tube over an internal alimentary canal, appears since in the higher animals is seen to the last, from the top of the head, between the two opposite halves of the forehead, the nose, lips, palate, chin, throat, thorax, abdomen and private parts unto the perinæum, to run a suture, which in some individuals in the regions of the lips, palate and private parts, remains ever incomplete and unclosed.

That in all animals which remain not mere zoophytes, and in which to the external surface is added a secondary internal surface, forming the cavity of the stomach, and that of the broncheæ or lungs, the former external surface is still in its formation the first, and the foundation of the latter:—that the latter hollows are only supplementary to, and only further extensions inward of the former surface, produced by the pressure of external air and elements on the incipient body, appears since even after an animal has issued from the ovum and has come in full contact with external air, not only the stomach but these lungs may still for a time be prevented from inhaling from that air, by the process of breathing, elements more copious, without the animal incurring from this suspension of the fuller nutrition it has become capable of receiving, any other effect than that of the sensitive faculties, which depend upon the more copious influx of those elements from air, not yet attaining their maturity: and since, when cold or other circumstances from without, cause any obstruction the lymph or chyle that are made to enter through the external pores of the body, this obstruction, in its turn causing an alteration in the exsudations flowing out through the internal pores of the stomach, in the shape of gastric juice, and in the internal pores of the lungs in the shape of carbon, im-

pairs the functions of the whole of the gastric and pulmonic systems.

That in entities organic and living, of elements from without, the influx, circulation, nutrition, change, renovation, deperdition and exit, which is first and most fundamental, and exists where none other exists, and, where any other appears, precedes and causes that other, is that which is carried on through the external pores at the surface of the body; that all influx of elements aerial from without, through tracheæ, broncheæ, lungs and other organs, which again to veinous blood adds more arterial blood, and all influx of elements aqueous from without, through stomach and bowels, which again to prior chyle adds new chyle more copious and more substantial, is later and secondary, and founded in part on the first, by elements from without, on the solid parts of animals more elastic pressing deeper inward, and forming in them as it were greater dents, before they are with the fluid issuing from these dents again mixed in new fluids pressing inwards, appears since in all vegetables and in some animals there is an external inhalation and exhalation, both aerial and aqueous, where there are not yet either broncheæ or stomach, while, where there are the latter, these are always preceded by and composed of part of the same elements with the former.

That in animal formations, after the ovum

or placenta, the parts within these parts more external and fundamental, called abdominal—namely, those which from that placenta sprout first inward into the parts gastric, pulmonic and hepatic,—are the earliest and most fundamental, appears since, on the foundation of the placenta, these are through the umbilical vessels or cord first within it formed, and since only later on these again arise the muscular envelops that, withinside the placenta, again enclose them, and only out of these prior parts gastric, pulmonic and hepatic are again made to arise, to grow and to elongate upwards, those ducts or spiracula or tracheæ of an anterior sort that end in the orifices of mouth, nose, ears and eyes, and downward those other ducts, spiracula or tracheæ of a posterior sort that end in the orifices of the bowels and excretory ducts, and finally laterally those still different ducts of a transverse description anterior and posterior that end into extremities or limbs again later closed up and becoming solid; and since to the last from the parietes of all these parts, even those like fingers and feet, afterwards closed up, still continue to exsude a peculiar mucus or fluid, in the lungs and mouth called saliva, in the stomach called gastric juice, in the nostrils called nasal mucus, in the ears called wax, in the eyes called lacrymal fluid, even between the fingers and toes only called by the more indefinite name of perspiration, similar to

the fluids of the more internal parts from which these excrescences and extremities first in part were derived, and which, when again exsuded and mixed with new elements from without, on these more fundamental parts, still merely vital, again form the organs of different senses.

That while the ovum and placenta still continue to envelop and to enclose the parts proper within, these parts proper within already absorb fresh elements from without, not only at the umbilic and through the general pores of the surface, but also at the mouth and other later and more partial orifices later on them superstructed, appears since already long before the animal issues from the ovum are, partly by elements from without taken in, from the lungs and stomach within formed outward those parts more prominent, whose influxes from without consequently do not first begin, but only are greatly increased, when the animal, disengaging itself from its external envelops, is first launched into outer air.

That, in short, in certain streams of fluids from the earlier, more inward, and more fundamental parts proper of the animal body driven outward in surrounding air, being at their exit from the body, in part by new elements from without rushing in, stopped, and with these combined in new organs, serving as spiracula to the fluids going out, and as trachea to those coming in,

begin not only all the later and more external organs of mere vitality, such as stomach and lungs, but all those of sensation, of intellect and of voluntary reaction outward—all the features of the face, all the organs of the brain, and all the limbs of the body—that of all these the commencement is found in certain spiracula and tracheæ, through which certain fluids, from within driven out, are by new aerial elements from without penetrating inwards arrested and made with these to form new recombinations, appears since not only the mere tracheæ, broncheæ and lungs, through the medium of which blood arterial is converted into blood veinous, arise in this way, but since all the organs sensitive, cerebral and of voluntary action—from the tentacula of asterias and medusas, and the proboscis, antennæ, eyes, and even wings and legs of insects, to the mouth, nose, ears and eyes, and organs of thought in the brain, and arms and legs issuing from the body, of higher animals,—begin in spiracula, tracheæ, tubes, cavities and ventricles, from without letting in air and aerial elements and influxes, and from within letting out vital exsudations and effluxes, which there meet, and by the pressure from without are partly consolidated into new organs, and partly, through these new organs, in their fluid state, made to re-enter the system ;—this process even being visible at first in those limbs and extremities, which afterwards,

by such opposite fluids from within and from without meeting and consolidating, become by degrees entirely choked up and solid.

That where in animals of a more complex sort, at a later period of their development, their broncheæ, first at their origin wider and shallower, are elongated outward, and in their elongation are contracted into a longer and narrower tube, called eustachian tube, before they end in the orifice of the ear, and force the air and carbon from within, which even in fishes still is emitted through these broncheæ, to be in beasts, in birds and in man forced out through those other outlets, at first only destined for the stomach, of throat, mouth and nostrils, appears since to the last there remains a communication of the lungs, through the eustachian tube, with the ears; since when the functions of the lungs are disturbed, those of the ear are often so likewise, and since when sounds from without are through the orifice of the ear made only to be conducted to the brain in an imperfect manner, they have, through the orifice of the mouth and eustachian tube, their transit supplied.

That animals in the progress of their development in and out of the ovum, not only have of some of their tracheæ the ducts, by the increase and swell of their surrounding parietes, so filled up as to end in solid limbs, but have of other of these tracheæ on the contrary the

whole substance and form again, by the preponderance of surrounding parts so reabsorbed and sucked in as to disappear, is evident in the tail of a tadpole, which by degrees, as the hind legs grow and elongate, has its elements again by these legs reabsorbed; and even in the tail of man, which first, in the fœtus, very visible, is again, long before that fœtus takes its last distinct shape, in the same way again reabsorbed, and made to contribute to the growth of the hind quarters.

That, as in vegetables between the glands formed one way, called roots, and formed the other way, called leaves, the intervening stalks and stems only later proceed from the elongation of the vessels upwards, which from the earlier roots ascend to the later and higher leaves, and downwards, which from the earlier leaves descend to the later and lower leaves, so in animals, which by degrees longitudinally one way, between their body and their head, and the other way, between that body and their tail, and moreover latitudinally, between that body and their lateral extremities, have intervening parts elongated in neckings very long, very slender, and very contrasted with the expansion and swell of the ultimate parts to which these neckings lead; such as are shown by certain insects—wasps, dragon flies and spiders,—and even by certain beasts and birds —antelopes and giraffas, swans and storks—these

neckings are partly by the pressure from the body elongating outward, and partly by the counterpressure from the extremities elongating in the same proportion inward, formed and made to grow, and are only increased in proportion to the more aerial nature of the fluid in which these animals are first formed, and which they continue to take in, appears, since these neckings, wherever they are produced, only are produced and made to grow one way, outward, out of the organs that support them, and the other way, inward, out of the extremities which they themselves remain attached to; since in animals as in vegetables the extreme parts themselves—in one the leaves and roots, in the other the features and limbs—make their appearance and protrude from the body, prior to those intervening neckings; since in animals of an aquatic sort, such as fishes, these intervening neckings never appear; since in those which from aquatic become aerial, it is only after they have become aerial that these neckings appear; and since in human beings, in which early in their fœtal state the brain has slipped out of the head, and remained huddled in a bag behind it, for want of the usual counterpressure from the head downward, the neck never acquires its proper length.

That where a limb is lost, and is not by the later fluids from the body flowing out replaced, it is only because these fluids are absorbed by

the neighbouring organs, appears since by this loss these neighbouring parts are the gainers, and thrive and increase upon the superfluous fluids which the lost limb leaves unemployed.

Having thus made all the essential observations that occurred to me respecting the substructure and scaffolding of parts merely vital, on which in animals were superstructed the later parts sentient, thinking, and voluntarily acting, I shall now pass over to these latter.

CHAPTER XX.

Sensation.

I NOW pass over to that attribute in animals, without the addition of which all the former attributes thus far described in them would have been to their owners of no avail: without which, to crown them, all the former ones might as well not have existed; to that attribute which seems indeed to have been the only object of all the former ones:—the only attribute that stamps on the former ones all their value; that through which alone the former ones, which add not themselves this latter attribute to the others they have, can be known, be appreciated; of which the former ones seem only, where this latter sort exists, to have been the prior foundation, base, ground-work and scaffolding; without which the former ones could not even have been described or known;—since in fact we only know, only can describe insentient entities, in the way in which they are by our sensations represented to us. I mean the attribute of sensation itself.

The word sensation means a feeling, a consciousness of a thing which may itself exist, independent of and prior to that feeling or consciousness of its existence.

What the other words by which I explain its

meaning—namely, those of feeling and of consciousness—are intended to express, I must appeal to the understanding of my reader for comprehending, without any further comment or explanation on my part. These words are the audible signs for phenomena which occur so constantly, and concerning which human beings so constantly communicate with each other, that their meaning can scarcely be liable to misconstruction. At any rate I cannot substitute to them any other words more notorious, more familiar. Any attempt to define them by other terms would only render my explanation more circuitous, without rendering it more clear.

All I can attempt to define is the extent of the phenomena that partake of the nature, and ought to participate in the name of sensations; and in doing so I shall show that this extent is much greater than it generally is supposed to be; that, though all sensations are not yet such as are called ideas, all ideas still partake of the nature of sensations; that, in order to be consistent in our application of the word sensations —to continue giving it, wherever we continue to find the conditions to which it was first applied—we ought to give it to all ideas of the mind, as well as to all feelings of the body.

The word sensations is first applied to the feelings, the consciousness of events and entities withoutside our own individual, of which we receive in that individual a feeling or consci-

ousness. Among which are first those of time, space, quantity, proportion, divisibility and number, received to a certain degree by each of the five senses alike, and next those of touch, taste, smell, hearing and sight, each only received by one of these five senses, to the exclusion of the rest.

The word sensation is likewise, or at least ought, by the same rule by which it is applied to these feelings and consciousnesses, coming directly from objects without, to be applied to all later repetitions of them, which, after the external objects themselves, first causing these sensations, have ceased to impress us, still continue later in our individuals to arise out of them under the name of ideas, or thoughts, from those primary thoughts merely called recollections of prior actual sensations, to every other sort of thoughts most abstract and most recondite, which in their turn are the later offspring of these former: for like the former impressions these latter are supposed to come from and to represent something outside, and prior to themselves; and whether in reality they do so or not, we shall prove that they are produced in us by the same sort of mechanism, by which are produced the sensations which come more directly from an external cause.

Indeed when ideas of the mind are of a very intense and forcible description, we seem still often to be mindful that these ideas in the brain

have a common origin with sensations of the body, and still often call them by the more generic and primitive name of sensations. We say that people are subject to very strong sensations of peculiar impressions—of joy, of grief, of ridicule, of ennui and others;—but in general we are wont to regard ideas in the mind as having an origin, a nature wholly different from those of the sensations experienced by the body. Of this opinion, however, I shall presently show the error.

We shall here only first discuss the sensations of the body.

We deem all these to be effects, nay, representations of certain events and entities, more early and external than themselves, which precede and which surround their locality,—of certain external modifications, from those of mere time and space, to all others more partial, again included in these, which we experience; and deem them caused by the impressions which these events, entities and modifications make upon us.

Thus we deem certain modifications to exist withoutside us, which give us the impression of time, of space, of force, of pressure, of movement, of substance, of tangible form, of radiance, of gaseousness, of liquidity, of solidity, of cold, of heat, of savour, of odour, of sound, of light, of colour, of form and motion visible to the sight, and of the other attributes from without, of which we are conscious; but this belief is only a later

inference drawn from the order in which, in the sensations of mere time and space, again in their turn arise certain of these other sensations more late and partial, again included in them. It is a circumstance not directly implied in the meaning of the word, nor directly proved by the nature of the thing. Sensations intrinsically are; but sensations do not undeniably prove that there is a something earlier than, and outside themselves, from which they are derived.

In its capacity as giving a knowledge of a more external and early object, of which it leaves the impression, and which may intrinsically exist, without giving that impression, that knowledge of it, we also call a sensation by the name of consciousness, i. e. of science or knowledge of another thing different from itself. Instead of saying that we have a sensation of another entity outside us, we often say we have a consciousness of such another entity.

Finally, we often call a sensation, in reference to the supposition of its only being received from a more distant external object, through the intervention and medium of some other nearer object, which we call an organ of sense, and through which the impression of it first passes further inward, previous to its producing actual sensation or consciousness of it, a perception. We say we perceive a feel, a taste, a smell, a sound, a light, a colour, a form; especially when the sensation is a faint one: but still the word sensation is the

simplest and the most general word that can be used for the phenomenon to which it is applied, when that phenomenon is regarded in itself, and without any reference to whence it derives or to what it represents.

How it happens that certain modifications, to certain entities withoutside them do not give a sensation of their existence, of their differences from other modifications; and that to certain other entities withoutside them these modifications do give such sensations; what other modifications earlier and simpler than those of which we receive sensations there still may exist, of which none of us yet receive any sensations, and which none of us yet know, yet suspect, are still secrets of nature, by the first cause withheld from our cognizance, and concealed among the earliest unknown attributes of matter. We must thus far rest satisfied with knowing that certain sensations do arise; and with believing that the cause of certain of these sensations arises out of that of certain others; because we always see them, where they exist, only follow those others; because we only find them, where preceded by those others.

All sensations of the external sense are moreover supposed to be the effect of, and to come directly from, the impressions of certain earlier and more distant external objects and modifications; to be analogous to the intrinsic nature and attributes of the objects from which they

come; to represent these objects and modifications. Those of time and space themselves consequently represent earlier external time and space; and those situated in the sensations of time and space, represent the earlier and more external attributes situated in the attributes of time and space. Those sensations that come from similar external attributes and impressions always come in a similar shape, and those that come from external attributes and impressions of a dissimilar sort, always come in a dissimilar shape. Those sensations later, more complex and more partial than those of mere time and space, which necessarily come included in certain of those of time and place themselves, always immediately following and immediately included in that external time and place, and in the other external attributes again included in those of time and space themselves, in the sensations of time and space present an order exactly following and tallying with the order in time and place offered by the real external objects and modifications, whence they directly and without any circuit proceed.

That by the will of Providence sensations only arise in certain peculiar organic forms, composed of certain peculiar elements, may be inferred from sensations only existing where have been matured those peculiar organic forms, arising out of these peculiar elements.

That of those peculiar elements nitrogen seems the first and most indispensable, may be pre-

sumed from such organic entities only as receive in their first composition a certain quantity of nitrogen becoming animals, i. e. entities capable of sensation.

It is probable that nitrogen, mixed in certain proportions with the other elements required to render entities organic, gives them that elasticity, which is necessary afterwards to enable them to admit the later influxes, upon the reception and combination of which sensation depends; and to receive from these the peculiar impressions, in the consciousness of which that sensation resides.

As entities have in their first composition more nitrogen, and as that nitrogen enters more considerably in the first composition of certain of those parts, they afterwards acquire faculties of sensation more extensive and more developed.

It is through these sensations that we are made first to believe in the existence withoutside them of certain means, certain modifications, certain objects, different and distinct from each other, some only giving the impressions that cause the sensations, others also receiving such sensations. That, for instance, we believe in the existence of a stone, a vegetable, an inanimate entity, still unable to receive a sensation, being able to give to an animated entity a sensation; and in the existence of an animated entity being both able to receive a sensation from that inanimate entity—that stone, that vegetable,—and able to give a sensation to another different animated entity.

It is through means of certain sensations being so much more permanent than others, that we accustom ourselves to regard certain of these sensations as proceeding more directly from the impressions of a body of our own—from what we call our own individual; and that we regard certain others, more transient, as only, through the medium of that body of ours, received from objects more distant and more shifting.

In what we thus regard as a body of our own, we so often, in certain parts different from others, receive from the same external objects sensations so different, and from objects very different sensations so similar, that we at last regard certain parts, certain organs, as only fitted to receive certain peculiar sorts of sensations, and not others; and these organs we call organs of peculiar senses. We begin to believe that peculiar sensations do not depend solely on the objects by which they are given, but also on the organs, the instruments, by which they are received:—on the peculiar manner in which these instruments alone can be affected by these impressions.

Men very often are heard to say, that they have received a sensation from an object in time and space, still distant from them; that they have seen a star twinkle in the firmament; heard a gun fired many miles off; the warmth of the sun, the coolness of the moon. But this mode of speech, in its absolute sense, is only a *façon de parler*. The first cause of every sensation

may indeed be as early as the beginning of time, as distant as the outskirts of space; but the cause that immediately produces the sensation, whatever object it more distantly comes from, must be in immediate contact with the organ in which its sensation arises, ere the sensation actually arises. It can no longer be in the object from which it is said to come, if that object be distant from the said organ in time or place. It is only after of a star the light has traversed the whole intermediate space which separates the firmament from the human eye, that in that eye there can of that light arise a sensation: it is only, after of a gun fired off, the vibration has advanced till it reaches the ear, that that ear can hear the report; we do not feel the warmth of the sun, the coolness of the moon, till long after these forces have quitted those bodies, and, athwart intervening space, have reached, and have penetrated in our pores.

As of the sensations which we receive there are certain sorts, such as those of time, space, quantity, proportion and number, which we can receive without receiving any others, while we cannot receive certain others, without their being included in certain of these first, we must suppose them to be the first and most general which any organs of sense are rendered capable of feeling; and it therefore is with the faculty of feeling these that we shall begin our investigation of the faculties of sense.

CHAPTER XXI.

On what does in certain organs of animals depend the faculty, not found in any of the organs of mere vegetables, of receiving at certain periods, and under certain circumstances, certain sensations.

Man in general, more frequently and familiarly surrounded, not only by the higher vegetables, but by the higher animals than by the lower ones; of the higher animals, more strikingly different from mere vegetables, taking greater notice than he does of the lower ones, which differ less from mere vegetables, and in these higher animals observing the higher attributes, in which they differ most from mere vegetables, and which in themselves are later, more superstructed and more exposed to the eye, before he notices in them those other attributes in which they still resemble these vegetables more, and which are more early, more fundamental, more underneath the former concealed from the sight, sees and notices the differences which in animals are again superstructed upon the resemblance underneath which they still retain to mere vegetables, and which again distinguish them from

these, before he notices and discerns the more early and fundamental resemblances which animals still retain to vegetables. If by accident he stumbles upon animals which, like zoophytes, have few of the later differences that again distinguish animals, superstructed upon the earlier resemblances which still assimilate them to mere vegetables, he is apt to regard these animals more as exceptions to all rule, as deviations from all regular series, than as the earliest specimens of a new species; as the intermediate link which connect the last of the mere vegetable class and the beginning of the animal genus. Thus it is that he begins by still considering the mere vegetable genus and that of animal as separated by an immense interval.

But by degrees, when he happens more minutely to consider such entities as that bothryllus which still, from the general inorganic base of the earth only, like a mere vegetable, shoots forth stalks in indefinite numbers; as that pyrosoma, of which the different stems still from their base to their summit remain connected, by certain vessels which adhere to each in turns, and only successively pass from the one to the other; as that zoophyte which resembles a plant terminating in a flower; or that polypus which resembles a flower only, which bears the very name of sea-anemone, which still suffers itself to be engrafted on other individuals of the sort, or to

have its own stool and petals again divided from each other, and each part again, like the fragments of a poplar tree, is made to reproduce the other parts wanting, and singly to rebecome a perfect polypus;—and when he nevertheless in those entities, still so like mere vegetables, recognizes faculties of sensation which only belong to animals, he begins to waver; he thinks that, between the mere insentient organization of vegetables and the sentient organization of animals, the line is less distinctly drawn, the transition is more gradual; that as the former sort of organization is the necessary foundation of the latter, out of certain developments of that former, the latter arises more certainly. He then asks himself, what are the conditions by means of which, out of mere organization, arises the power of feeling?

He finds that the power of feeling does not depend upon entities having a general form visibly different from that of mere vegetables; for mere zoophytes have not such a form, have only, like vegetables, an absorption of elements aerial and aqueous, directly from without; have not any internal lungs or stomach, any internal cavity, through which passes either more aerial or more aqueous food, before it enters the system; —and yet they feel.

He only finds that they depend for the faculty of feeling on having superstructed on the organs of mere vegetables, which are not sentient, cer-

tain other organs which indeed can only be superstructed on the former ones, and which are sentient, but which are so minute that they remain imperceptible, and do not materially alter the form, disposition and appearance of the former ones themselves. He finds that these new sentient organs can be superstructed on the prior insentient ones only, where these prior insentient ones themselves already possess certain qualities, which the insentient organs of mere vegetables do not possess; since there is no reason why, if they did possess them, they should not, in time and by degrees, from mere vegetables all grow into animals.

Now what are these qualities, these conditions, which the organs of mere vegetables do not possess, and which alone can qualify those entities that do possess them to become animals?

They are not merely the being composed of time, space, electricity, gravitation, light, colour, oxygen, hydrogen, nitrogen. All these elements are already, in a certain degree, necessary to certain mere vegetables. Though animals are considered as having more nitrogen than vegetables, among vegetables the acrid cruciform already has a quantity of nitrogen approaching to that of animals.

Yet of that nitrogen a greater quantity than is found in any vegetable is found in all animals; and this nitrogen, therefore, though not yet pro-

bably itself directly forming the sentient organs of animals, already itself, where in greater quantity, gives the insentient organs of animals that superior elasticity necessary to admit the greater quantity of other elements, not yet admitted in the composition of the organs of vegetables, destined to remain such only, which is necessary for affording room to construct in other entities, destined to become animals, the organs necessary to receive sensation.

Nitrogen does not probably immediately produce powers of sensation; but when in certain proportions it produces in insentient organs the capability of superstructing on these the other later organs, which, when consolidated, matured, and put in the situation necessary for the purpose, receive powers of sensation.

Now what in sentient entities again are the elements; what is the fluid—of which in certain entities, certain proportions, when consolidated, when matured, when put in the situation necessary for the purpose, actually receive these powers of sensation?

In order to ascertain, to investigate this, I must begin by ascertaining, by investigating, where are first seen the organs that acquire those powers of sensation, and from the meeting of what fluids, what elements, they can first be supposed to arise; and in order to do so, I shall be obliged to expose, in reference to the first

locality and origin of these organs, some errors which still lie in my way and obstruct my progress.

Most people taking their idea of the first locality and origin of all organs of sensation only from those of higher and more complex sentient entities, in which again they see them further removed inward, fancy that in all animals these organs have their first origin in the interior parts of the frame, nay of the head, and thence proceed, in the shape of nerves, to the more external parts of that frame.

But it is contrary to analogy that the first causes of sensation should arise from without, and that the first vehicle of those sensations should, instead of likewise arising from without, first arise from within; that they should have a course opposite to their cause. This would be the contrary to what takes place in all other channels conveying the causes of certain effects from one place to another; all these begin from the same point from whence begins the flow of the elements which they convey, and by which they are first caused.

It is also contrary to observation—to experience. We find animals not yet endowed with heads, not even yet endowed with nerves, which already offer symptoms of sensation. Consequently in these the organs of sensation cannot begin in the head; and they cannot be nerves.

I therefore believe, that of faculties of sensation the first origin arises in organs of which the roots are situated directly under the pores of the external surface or epidermis, through which first from without come the immediate causes of the sensation itself, and directly over the muscle further inward, on which arise the first causes of that sensation. That these roots of the organs of sensation, there individually consisting in mere glands or papillæ of excessive minuteness, there collectively form the tissue called dermis, which, in inferior animals, where the papillæ of sense are only at great distances diffused in very small numbers, is very thin and difficult to discern; but which in higher animals, where a greater number of these organs are more approximated, becomes a dense tissue, notwithstanding in these higher animals only the first half or roots of organs of sensation remain near the external surface—notwithstanding in these higher animals ducts inwards, called nerves, at certain distances collected in cords or fasciculi, are made to carry the further elongations of these sentient roots, which form the actual sentient halves of the organs of sensation further inward, before they collect them in the ganglia or brains in which first the actual sensation begins. I believe the nerves only to be tubes or channels, from these roots prolonged further inward, and collecting the internal sentient extremities or blossoms of these

roots in foci more condensed, called ganglia or brains, and carrying to these the influxes and impressions from without, before in these is from them received an actual sensation. I believe the general dermis to perform to the sense of feel the office which the retina of the eye performs to the sense of sight in particular.

If so, like all faculties, all instruments of sensation first commence from without.

Now it appears, that even from without, in an animal, neither in the mere lymph formed by the remixture of part of the first and most fundamental saps with new aerial elements descending from on high, nor in the mere chyle formed by the remixture of another part of the same first and most fundamental saps with the aqueous elements ascending from underneath—and which two fluids only in animals hold the place, which in vegetables hold the descending and ascending saps—when consolidating, yet acquire the faculty of immediately receiving sensations, since neither the solid parts internal, nor the solid parts external, formed of mere lymph or chyle, yet receive sensation; since neither internally the serous membrane that surrounds the viscera, nor the periosteum of the bone, nor externally the epidermis, the rete mucosum, the nails, hair, bristles, wool, feathers and other substances, formed of mere lymph or chyle, while still unmixed with parts formed of blood and blood-vessels, yet acquire the least power of sensation;

as we perceive when we cut our nails, and curl our hair.

But when lymph and chyle again are remixed in blood, even merely veinous, and when this blood is again from within driven outwards, and with fresh elements from without flowing inwards remixed, is again driven inwards, then, as soon as the parts in which it consolidates are sufficiently matured and in the proper situation, it appears to acquire powers of conveying sensation.

In animals in whom we still only find veinous blood, we already find such powers of sensation; and in animals who to veinous blood add arterial blood, we only find this blood produce organs of sensation more exquisitely sensitive.

Even the parts internal and external, fundamentally only composed of lymph or chyle, and fundamentally insensitive, when by lesion or disease they are made penetrable to blood from within, and to aerial elements from without, out of the meeting and combination of these two opposite substances, over the vessels in which this blood flows, form organs of sensation unheard of before;—as we may see in bones, when broken or affected by rheumatism, blood from within and air from without penetrate their substance, and may see even in hair, when, in the disease called plica polonica, its tubes, before empty, become blood-vessels.

It is thus from the remixture on one side of

blood from within, and on the other side of aerial particles from without, that first arises in animals the fluid called nervous, which composes organs of sensation; and the external muscle is the chief soil in which these opposite fluids have, by re-uniting and remixing, the opportunity of forming and of consolidating together in the glands, requisite for the purpose of receiving from without and conveying inwards the impressions that cause sensation.

In fact, as in entities the blood from within remains less exposed to remixtures with elements from without, the sensibility is less. In people long bedridden, or confined in gaol, or otherwise debarred from free communication with air, sensation becomes blunted, deadened. In people greatly addicted to air and exercise, it becomes more intense, more susceptible both of pleasure and of pain very vivid.

What proves that the elasticity sufficient to produce organized entities unendowed with organs of sensation, was not yet sufficient to produce entities able on their more insentient organs to superstruct organs of sensation; and that the elasticity sufficient to produce entities able on their insentient organs to superstruct a few organs of sensation, was not yet sufficient to produce entities capable on their first sentient organs to superstruct other organs of sensation higher and more complex, is that on this globe we see, in the remains of former entities a regular gradation

and progress not only from the relics of entities inorganic and lifeless to those of entities living without feeling, but from these again to others also sentient; and from those only possessed of organs of sensation few and simple, to those having organs of sensation more expanded, more varied and more complex. The lower strata of undisturbed remains only being composed of the former, and the higher ones only of the latter.

I believe that in sentient entities the blood from within, driven outward, only with elements from without driven inward is mixed and combined into the organs of sense, which, when matured and exposed to fresh influxes from without, are capable of receiving sensations of the same sort of influxes from without, of which they were first composed.

This may at first sight seem a paradox, an absurd belief. A man may have sensations of feel of a peculiar engine, of taste of a peculiar dish or beverage, of smell of a peculiar perfume, of hearing of a peculiar piece of music, of sight of a peculiar painting or pantomime, which, being a production of art, must assuredly have first been combined only long after the human organs of the different senses were first founded and formed.

But these productions of art are themselves first only composed of certain combinations of simpler elements, which already existed in nature previous to the existence of man, and out of these

same sorts of simpler elements of nature may already have been composed the organs of the different senses themselves, out of whose combinations were composed the instruments, calculated to perceive the combinations of these different productions of nature in works of human art.

And that this was the case, appears since the different organs of sense thrive, invigorate and increase only upon further influxes of the same peculiar elements from without which they are calculated to perceive, in certain quantities and proportions, and since these organs, like all others, only thrive and increase and invigorate upon elements similar to those of which they were first formed and composed.

All organs of sensation, composed on one side of blood from within, and on the other side of elements from air without, must thus, through the medium of that blood, itself already first formed only out of elements from without, already in part more remotely have been founded out of such elements from without, and must, through the medium of further elements of the same sort, subsequently again taken in from without, in greater quantities and more directly, have by this greater accession of the same elements, been later finished and matured.

All organs of sensation, alike capable of receiving sensations of time and space, and quantity, proportion and number, must, as nobody

can doubt, alike have been composed of certain portions of time, space, quantity, proportion and number, and to these fundamental elements and attributes, in their first formation, the organs of feel in particular must have added portions of those attributes of pressure, of resistance, of cold, of heat, of dryness, of liquidity and of all others, by their combination in time and place, producing tangible forms and movements, of which the touch receives a consciousness; those of taste must have added certain portions of those elements of the different flavours of which the taste receives a sensation; those of smell must have added certain portions of those modifications of scent of which the smell acquires a perception; those of hearing must have added certain portions of those modifications of substance and movement—of resistance, of pressure and of vibration—by which the hearing is afterwards struck; and those of sight must have added certain portions of those modifications of light and of colour—by their combination in certain portions of time and space, producing visible forms and movements—by which the sight is afterwards excited to sensation.

Of zoophytes, in which there is not yet of the pressure from without inward, a recoil, a pressure outward sufficiently strong and definite to produce a distinct head and distinct limbs, the blood from within not yet pressed outward to the surface of a face and of lateral extremities, can still

only be driven to all the different parts of the surface of the body, in small and equal quantities, and on all these alike be, with different elements from without remixed in different minute organs of the different sensations which they experience, so as over the whole body to receive sensations of feel, of taste, of smell, of hearing and of sight; and in fact, we already see zoophytes without distinct mouth, or nose, or ears, or eyes, already affected over a great part of their body by certain modifications not only of feel, but taste, smell, sound and sight.

And it is only in animals later and more complex, endowed with a head and with limbs, that the blood, more peculiarly driven to these extremities, there with new elements from without, on organs first only insentient, forms organs of feel, taste, smell, hearing and sight more separate, more each collected and concentrated, and consequently more each capable of receiving from further influx of the same elements, sensations concentrated, distinct and vivid.

If any doubt could remain that organs of sense are first composed of the very elements, of the further influx of which afterwards, when matured, they become capable of receiving sensations, this doubt must be done away by these organs feeling, in case of a disorganization sufficient to make them lose a certain portion of their component substances, but not sufficient to deprive them entirely of the power of sensation,

the same sort of elements, of which they receive the perception, again driven out of them.

We sometimes feel, without any cause for these phenomena in the external world—without any pressure or influx of external forces and substances accountable for the effect; in a state of entire external quiet, silence and darkness, and in consequence only of mere disorganization from within,—of mere decombination and efflux of part of the elements of which they were originally composed,—in the organs of the sense of touch, from within a peculiar degree of cold, or heat, or pressure, or shivering, or irritation, again making its way outward. We feel in the organs of taste, when we are in ill health, disagreeable and mawkish flavours again from the stomach issue outwards; in the organs of smell we find, when unwell, disagreeable fumes again from within, making their escape. Even, when indisposed and nervous, we feel the ears affected by noises, by ringing from within; and after a sound night's rest, during which light and colours may be supposed to have accumulated in the eye, we find these lights and colours, on awaking and unclosing these eyes, again in perfect surrounding obscurity issue from that eye in the shape of scintillations and of sparks; nay we find by blows and by violent pressures these sounds made to be driven out of the ears, and these lights made to be pressed out of the eyes, with greater intensity still.

As only on prior parts vital that are not sen-

tient, can first arise that blood which, in peculiar directions driven out, and arrested by, and mixed with peculiar elements from without driven in, can with these elements from without be recombined in peculiar organs of sense, it is on the elements issuing from the prior vital parts which still are themselves insentient, that must depend what elements from without they can recombine with in organs of sense; what organs of sense can on the vital parts of an animal be constructed, and where these organs of sense can be situated; whether they still may be over the general surface mixed together, or whether they must be separated from each other, and each driven to a peculiar part of the external limbs and orifices; where those of different sorts shall be more separated from each other, and where more of the same sort shall be more combined and concentrated, and made to receive sensations more distinct and more clear.

Already in mere atmospheric air, wherever it offers sufficient resistance, may be formed not only solid bodies inorganic, and solid bodies organic still insentient, but even solid bodies which, to organs only vital, shall again, through the medium of blood, add organs of a sentient sort. Such bodies perhaps we inhale when we are poisoned by mal-aria. In water may arise myriads of other sorts; and on land, between air above and water underneath, may again be formed millions of other sorts, imperceptible to the naked eye.

CHAPTER XXII.

Pleasure and pain.

It has by some been fancied, for reasons which I shall not here detail, that in animals in organs calculated to receive sensation of any sort, sensations of pain are experienced prior to sensations of pleasure; that consequently, as pain only proceeds from evil, and pleasure from good, evil is experienced before good. This is not true; it is not analogous to the process of nature. Organs, by meeting of saps from within and elements from without formed and increased and invigorated and matured, till they acquire faculties of sensation, must, as long as this meeting of opposite saps takes place, in quantities calculated to increase their size and vigour, increase their sensation of pleasure. This circumstance experience shows to be the case in all organs of sense. Whether they only become conscious of mere duration and expansion; whether of force, movement, impulse, resistance, gravitation, electricity, cold, heat, substance or form, or whether of impressions of other modifications of touch, taste, smell, hearing or sight more definite, these sensa-

tions, as long as sufficiently moderate to benefit the organs, are grateful and pleasant. It is only when the modifications that cause them, impress or flow in the organs in such quantities, and with such force, as to lose their balance with the blood that flows in them from within, as to overpower that blood and the organs themselves first out of prior similar elements composed, and as again of these organs to promote the decombination—to injure them—that the sensation, before pleasurable, begins to become painful, and increases in painfulness as the injury increases, until by the entire destruction of the organ, the capacity in it of receiving all further sensation, either of pleasure or of pain, ceases altogether.

Where a phenomenon, as yet to us so inexplicable as that of certain influxes from without causing, with a peculiar impression, a sensation of that peculiar impression, takes place, it seems to add but little to its wonder, that, as long as the impression, the influx remain only in such quantities as to be beneficial to the organ, the impression should only remain pleasant, and that, as soon as they become so immoderate as to injure that organ, the impression should also become painful, and that, on the one hand, the benefit arising from an influx from without, in a quantity moderate and proportionate to that of the blood from within, causing the organ to extend and invigorate, should cause it from a mere

mechanical cause, and without yet harbouring any consciousness, any will, any intention of so doing, to experience an orgasm, a swell, a protrusion, making it suck in more fresh elements from without, and more fresh blood from within; and that again, on the other hand, the injury arising from an influx from without, in quantities excessive and disproportionate to that of the blood from within, causing the organ, on the contrary, to shrink and to weaken, should cause it to experience a depression, a collapsion and a retraction, making it shut out, and repel, and reject such further elements from without and blood from within, also from a purely mechanical cause, and without yet having any consciousness, any will, any intention to that purpose.

Thus the very same cause which causes an impression or influx in an organ of sense to remain beneficial and pleasant, causes it naturally to continue, and the very same cause which causes this impression, this influx in an organ of sense to become injurious and painful, causes it also naturally to cease.

Even after the influx first beneficial and thus pleasant has ceased to remain so, and has thereby alone, or by becoming actually detrimental and thus painful, ceased to be encouraged, the swell, orgasm, and protrusion, left by the former, or the weakness, collapsion and shrinking induced by the other, will in the organ leave a sensation

of that effect called, no longer in the organs of sense, in their capacity of organs receiving impressions directly from without, sensations of the sense, but called in these same organs of sense, in their capacity of also, in consequence of these prior impressions directly from without, receiving later similar impressions from within, recollections, ideas of the mind; and the same cause which causes in the organ, with this continued swell and orgasm, or depression and shrinking, this recollection of that impression agreeable or disagreeable, will cause the influx from without and the efflux from within which causes the impression to continue being sought, or to begin being shunned.

But as recollections are in an animal the first sensations, no longer called of the sense but of the mind—no longer coming chiefly from without, but chiefly from within—I must here stop and examine whether, as some people think, ideas of the mind are entirely distinct from sensations of the sense, or whether they are the natural and gradual later consequence and development of the external causes of these very sensations themselves.

CHAPTER XXIII.

Mind, intellect, understanding.

WHAT is mind?

It is an aggregate of faculties of which the earliest, most extensive, most fundamental and most simple consists in the capacity of summoning up in the body certain sensations, which proceed not immediately from impressions received from withoutside that body, but may, where such sensations have at any time preceded them, in their absence be still experienced.

It is the faculty, for instance, where we have felt from without certain feels, or seen from without certain sights, of again, without their cause again coming directly from without, experiencing repetitions of such feels or of such sights.

Mind is composed of certain sensations of time, or space, or quantity, or number or others, which are required to include in them other sensations more definite of touch, or taste, or smell, or hearing, or sight, and is also composed of certain of those other sensations more pointedly coming under the cognisance of peculiar senses, all which continue to be perceived, when the impressions from without, which first caused

them, no longer continue to flow in;—no matter whether these sensations continue combined together in the more simple sensations of time and place, in which they must be included, in the same order as those prior sensations of impressions that come directly from without, or whether they be combined in these in a new and different order.

Mind shows its existence in sleep as well as awake; in dreams as well as in waking thoughts; in pictures of objects, which in their composition are unlike any sensations of real external objects beheld, as well as in actual representations of such real external objects; in sensations faint as well as in sensations vivid: but whatever be the combination of the materials that form the pictures of the mind, their intrinsic nature, their quality is always the same as that of certain of the sensations, which we have first received from the impressions, by certain external objects made on certain external organs of our individual, first and most fundamentally called sensations of the sense.

There are people who have, between the meaning of the word soul and that of the word mind, made a difference. To have done so, they must have understood by the word soul the general capacity by God given to certain modifications—whether of matter or not of matter—to receive at a certain future period certain sensations or ideas, even before these modifications

had, by their development, received actual present possession of that faculty; and by the word mind, only the actual present possession of that faculty,—of those sensations and ideas. At least I can see no other difference of which the meaning of these two words is susceptible. The word soul seems to include the faculty of receiving certain feelings directly from without, as well as certain repetitions of these feelings from within; the word mind seems confined to the latter faculty alone.

As I have already observed, the sensations of the mind in their intrinsic nature still wholly resemble those of the external sense. Like the sensations of the external sense, those of the mind are in the first place more generally sensations of time, space, quantity, proportion, number and others, which are necessary to include and support those sensations more pointedly belonging to peculiar senses only to the exclusion of others, and, in the second place, are more peculiarly sensations of touch, taste, smell, hearing and sight, necessarily included in and founded upon certain of these former sensations. Oftentimes, while we are asleep, and in dreams in which none of the former sensations interfere with and eclipse the latter, these latter are themselves taken for sensations of the external sense; this even happens while we are indeed awake, but are in that morbid state called of insanity or delirium. When

in sleep we receive not through the external organs of sense actual sensations of impressions and objects from without, the sensations arising in the mind, in that case stronger than when we receive any sensations directly coming through the sense from without, are then themselves taken for such, or at least are not distinguished from them, and produce in the mind, and often in the body, the same effects which these would produce; we feel the same internal wills, desires and apprehensions; and often exhibit the same voluntary actions outwards. In general, however, sensations of the mind are less intense than those of the sense; those no longer of mere time and place have, moreover, a capability of being summoned up in those of mere time and place themselves, in an order no longer similar to the only order in which can be received sensations directly through the sense coming from without; which latter must always be experienced in the very same order in time and place, in which external objects and modifications directly produce them.

These phenomena of the mind have, in addition to their primitive, earlier and more generic name of sensations, which to all intents and purposes belongs to them as much as to the sensations of the sense immediately proceeding from without, received the appellations more frequently applied to them of ideas or thoughts. The former word, taken from the Greek verb

seeing, properly would only express those sensations of the mind which are derived from the sense of sight; and can only by extension be applied to others; the latter word, taken from the Saxon *thinging*, or thinking, is directly expressive of all sensations or ideas whatever of external things, through whichever of the senses they may be produced in the mind.

I have already said, that many ideas or thoughts of the mind are pictures and representations of the prior sensations of external objects and modifications received through the sense, but reawakened, in the more general ideas and thoughts of mere time and place, in an order totally different from that in which they were first received directly from without; and these ideas and thoughts are called more pointedly imaginations, fancies; and are only recombined in the mind out of and drawn from those prior ones, called recollections, which represent more faithfully and accurately those sensations that come more directly from the impressions of external objects and modifications.

There are other ideas and thoughts in the mind,—and these are the parents and present the materials of those called imaginations and fancies,—which, under the name of recollections, in the order in which they appear in the fundamental ideas of time and place themselves, tally exactly with the order in which through the ex-

ternal sense, we receive sensations immediately of the impressions which external modifications have made on the mind.

But both sorts of ideas and thoughts—those called imaginations and those called recollections alike,—are composed of the same materials; and these materials are sensations more internal and late, similar to and derived from the sensations more external and early, through the organs of sense received directly from the impressions of objects situated outside our individual.

Examine whatever picture of the mind, whatever idea or thought we please—the most late and, in the relative order of its lesser component parts, most differently combined from those of mere recollections, and we shall find that, only in the relative order in time and place in which these are situated differing from the component parts of mere recollections, they in their intrinsic nature and materials still resemble, or are the same, with the materials of mere recollections.

We shall find that only, as it were, by a mechanism, again different from the external mechanism that enables certain external modifications directly to play upon and to affect certain keys or instruments of sound, and more late and internal than that former mechanism, out of the same cords are drawn sounds, in their intrinsic nature still similar to the former, but only in their relative order in time and place less or more different from these.

And again examine and analyse whatever recollection itself we please, we shall find that, only differing from mere actual sensations received directly through the external sense from the impressions of external objects and modifications, in the period later and more distant in which they are received from these impressions, they still are received from and depend ultimately upon certain of these themselves. We shall find that, though no longer depending upon the actual presence of the impressions from without, on which actual present sensations of external objects depend, they only in this particular alone differ from these, and still more remotely and distantly depend upon certain of these impressions themselves for their existence.

But these recollections no longer depending upon the actual presence of the external objects, from which they are derived, and which they represent—able, after these sensations from without have preceded, by impressions of the blood to occur in the same organs in which elements from without caused impressions directly from external objects, even when the external objects themselves no longer are present, no longer even exist—are already the effects of impressions called of the mind, and no longer of the mere sense; and whatever animal thus is already capable of having such impressions, called recollections, derived from external objects which have existed, and have impressed that animal,

even after those objects no longer are present, has already a beginning of mind, of faculties of thought.

Already in very early periods of ancient history certain heathen philosophers, not deeply versed in natural science, but forcibly struck with the power of summoning up in the mind a sensation, an idea, an impression of external objects or modifications, when these objects and modifications that were the first cause of these ideas and impressions no longer were present, or even existed, conceived a notion that the mind, in which such ideas could arise, must in its nature and origin be entirely different from the nature and origin of matter. This opinion, this doctrine, seems entirely of pagan origin.

Plato adopted it from the east. Though unable, as every one else after him has been, to explain how material organs were able, from material objects and modifications withoutside them, to receive even the very first sensations of the external sense, before these material organs again produced other later material organs again in their turn able to prolong these impressions on the sense, in what has been called the mind, this first difficulty of his subject seems not to have startled him. Seeing evidently that the sensations of the external sense only arose out of material objects, in peculiar organs themselves composed of matter, he did not call the occurrence in question, merely

because he could not account for the way in which the wonder was effected.

But with regard to the mind, which seems more independent of external time and place, only because its organs are more concealed in the inside of the frame, and because their impressions are less visible to the eye, the difficulty of their receiving of impressions of mere matter a degree of consciousness—though in itself only offering difficulties in their turn arising out of those that already oppose the belief in mere organs of sense receiving of impressions of matter a degree of consciousness,—struck him more forcibly.

He therefore imagined, as others had done before him, that, independent of the sensations of the body and sense, and independent of those later sensations and ideas of the mind, which still, from their strong resemblance to sensations of the sense, and from their evidently immediately arising out of those sensations of the sense, could not be denied being in their nature and origin identical with the same, there were other ideas in the mind, by him called archetypes, which arose not out of impressions of the sense, but in their nature and origin were distinct from these.

This idea, first transmitted to us from the most ancient times through Plato, has been revived by modern philosophers, such as by Kant, under the name of idealism, or of transcendental phi-

losophy—not considering that the very words ideal and idealism, coming from the verb ideo—to see—itself only means a mental resumption of that operation of the sight which had first begun in the mere sense.

Leibnitz, indeed, anxious to support the doctrine of the pure immateriality of the soul or mind, first already conceived by certain heathen philosophers, and at the same time puzzled by the resemblance between these ideas and the sensations of the sense, had, in order to give to the ideas of the mind a nature and an origin totally distinct from that of the sensations of the sense which they resembled, and at the same time in order to account for this resemblance, while he believed certain ideas to be innate, and totally distinct, in their nature and origin, from sensations received from the impressions of objects without, still established, very gratuitously no doubt, between the two phenomena a singular coincidence, borne out by no experience, no fact, which should give each of the sensations of the sense its counterpart in the mind; and this phenomenon he calls pre-established harmony; but this doctrine is too wild, and too unsupported by any thing we see, to have had many adherents. Still the general indefinite belief that the mind must be in its nature different from the body—first broached by heathens—among Christians continues to this day to have many advocates.

There however already arose in ancient times men, who more guided by reason and experience, and less swayed by imagination, formed juster notions. Among these was Aristotle, who regarded all ideas in the mind to be derived from and combined of prior sensations in the sense.

In modern times this doctrine has again been supported, in England by Locke, in France by Condillac; but the vulgar still adhere to the opinion that soul, that mind, are totally distinct from sense.

This belief has been chiefly kept up by our hopes and fears.

We naturally wish for the life which we here enjoy, to be at a later period, and in a later world, hereafter continued—we naturally wish for what we call immortality; and we as naturally believe that if ideas, if mind, can be founded on matter alone, and if, as we think, matter is perishable, mind likewise must perish with matter. So far the reasoning is well conducted, the conclusions are well founded on the premises. But people have even gone further than mere reasonings. They have with these reasonings mixed feelings and bitter feelings. They not only have called those who broached the doctrine that mind originates in matter, materialists; but, considering that doctrine to be subversive of all the objects of our hopes and wishes, they have cast on those who

maintained it an indelible odium; they have even loaded them with persecutions. They have not considered in the first place that whether our opinions be true or false, so we take pains justly to found, we are not amenable for them; nor have they considered that if by chance their opinions prove true, we gain nothing by reviling their tendency, and persecuting their authors; and only lose the time and opportunities of which we might have availed ourselves for framing our actions accordingly.

Fortunately they have erred in the very principles on which they founded their conclusions—in stating that matter was perishable.

I allow that we cannot comprehend how, while in some modifications of matter no ideas arise, in other different modifications of matter ideas can and do arise: but is this a reason for disbelieving that ideas can and do arise in matter? There are millions of other phenomena which we are as little able to comprehend, and which we nevertheless most firmly and justly believe.

We cannot, in the first place, comprehend how any thing that is—time, space, force, movement, substance—can first arise where none such was before; that aught perceptible can come of nothing perceptible; and yet we believe that all we see first arose out of nothing perceptible, and believe this most firmly.

We cannot comprehend how time can be pre-

ceded by any thing not itself yet time: how space can be surrounded by any thing not yet space; and yet we believe that both time and space must have their limits, externally as well as internally; at one end as well as at the other: and that both must have had their first cause and author, prior to themselves.

We cannot comprehend how in time and space arose force, impulse, movement, resistance, substance, cohesion, certain entities not having elasticity enough to become organic, and other entities endowed with sufficient elasticity to become organic.

We cannot comprehend how, in addition to material objects, modifications of matter, having no sensations, no consciousness of the impressions by other modifications of matter made upon them, can arise material entities in which, of certain of the impressions by modifications of matter made upon them, arise sensations of consciousness.

And yet we believe all this to be the case, because we actually feel and see it.

And after thus believing that of matter certain portions receive sensations of the sense, because we feel and see them do so, we shall disbelieve that of matter these same portions likewise receive those other sensations of the mind, which we call ideas, so nearly resembling the former ones derived from the same source, though we also feel and see those modifications of matter

receive these, only because we cannot tell how, and by what virtue inherent in them, they do so!

We say, and justly say, that what we call immediate sensations of the impressions of external objects—the mere act of receiving from certain modifications of matter, in certain other modifications of matter, sensations, perceptions, consciousness of the sense—is an effect of a faculty residing in matter: but I ask whether this is a phenomenon more easily explainable by us than the act of the same causes having, in other modifications of matter, produced the sensations of mind—the ideas—of which we become aware. Yet the one we acknowledge to be, because we see it clearly, and the other, which we might equally see, we deny.

Things are not to be disbelieved merely because they are wonderful. If they were, we should believe nothing, for all is subject of wonder. The first creation is the greatest wonder of all. Later wonders only deserve to be disbelieved, where they are found to have no analogy with, not to arise out of, but to contradict, and to disagree with that and other prior wonders, already firmly and on just grounds established and believed.

Now, what is the case with the wonder of mind not growing out of matter, and with that of mind growing out of matter? In what does the latter wonder more disagree with all former wonders?

Is not God the first cause of matter as well as of mind: has not God even given matter precedence over mind? Do not the first attributes of matter lie as inscrutable in the bosom of God—of its first author—as those of mind? Has not even matter confessedly received from God the power of experiencing, in consequence of impressions from other earlier modifications of matter, certain consciousnesses called sensations of the same? Is not therefore the wonder of matter also receiving the consciousnesses of other matter called ideas of the mind, a wonder more flowing out of and in analogy with all former wonders, than would be on the contrary the wonder of this faculty of the mind not flowing out of any faculties of matter? It is a wonder which, so far from destroying our hopes of immortality, can establish that doctrine on a train of inferences and inductions more firmly established and more connected with each other than the former belief can be, as soon as we have proved that matter is not perishable, but is only liable to successive combinations and decombinations.

Can we look farther back one way into the first origin of matter than we can look forward the other way into the last developments of mind? Can we say that God has not in matter itself laid the seeds of every faculty of mind, rather than that he has made the first principle of mind entirely distinct from that of matter? Cannot the first cause of all we see and know

have fraught matter itself, from its very beginning, with all the attributes necessary to develope into mind, as well as he can have from the first made the attributes of mind wholly different from those of matter, only in order afterwards by an imperceptible and incomprehensible link to join the two together?

We cannot, it is true, deny that of the very first, and most general, and most comprehensive base and ingredients of all matter more late and partial, mere time and space, every portion, wherever it is perceived, is already perceived only as different from every other different portion of the same attributes of duration and of extension: that all time and all space appears as mere change, as nothing but change: that all else we can perceive within perceptions of mere time and space, founded upon and included in certain of these perceptions themselves, must also partake of their nature: that force, impulse, pressure, resistance to pressure, movement and even immobility, formed of time and space, and in time and space, likewise only exist through constant change: that substance and the feel of substance, arising out of pressure, is only the effect and the feel of a constant change: that not only change but stationariness, continuation, and the feel of these attributes, founded on the existence and the feel of change in time or in place or in both, is founded on the real attribute

of a change in place, in time, or in both: that the feel of the rock most durable, most unchanging, most stationary, most lasting both in time and in place, always changing in its situation in time, and, if the earth itself constantly moves in space, also with that earth itself in space, always changes: if we perceive objects organised and living, we cannot deny that they only appear liable to changes more rapid and more varied; to those of birth, development, maturation, decline and death: and if we also feel them as sentient, we only feel them as again to the changes of the body superadding those of the sense. We cannot deny that the attributes of mere vitality and even of sensation experience a change so rapid that it is supposed that in man, after the lapse of seven years, not one single particle remains of the elements that existed seven years before: nay, that, as all entities have their definite period of birth, of life, and of development, so they have also their definite period of death and of decombination.

But whether, like the phenomena of the body and those of the sense, those of the mind rest on organs of a material sort, or whether they do not rest on any such, we cannot deny that they too, as far as we know them, constantly change, till at last they again cease to be, and are decombined.

We cannot deny that when in an embryo first only composed of matter arises a mind; when

the infant, first only conscious of feeling, also begins to think; when, from thoughts which are only recollections of the past, he passes over to ideas which are anticipations of the future; when from mere concrete thoughts he passes to abstract thoughts; when from truths he passes to errors; from less to more experience; when with his ideas and beliefs, his wills, wishes, dispositions and habits, change; when from a puling infant he becomes a wary man, or again, from a shrewd man degenerates in a doting elder; when he acquires passions, or again loses them, constantly changes in mind as in body—that constantly of the mind, as of the body, the faculties and dispositions come, and go, and are replaced by others, till at last the whole aggregate again is decombined, and for a time, as well as the faculties of matter and of sense it contained, dis appears.

But is this a reason why mind, if it rests on matter, and the matter itself on which it rests, must entirely perish, must be annihilated? Is the temporary reverting of the mind, and of the sense itself out of which that mind developes, to their original component elements, a reason for thinking that they cannot again at another later period and in another higher globe again be recombined, and with more splendour than before? If certain combinations of matter first produced sense and mind, of which certain decombinations of that matter again for a time suspend the exist-

ence and exertion, why cannot other later recombinations of that same matter, in forms again different, recompose a body more perfect, a mind more capacious than the first? Already in the present period of time, and on the present globe, a man may, from a state of feeling and of thinking, fall in a state of dreamless sleep. He may in that state from England be conveyed to France. He may at a later period, in a different place, not merely again awake, again feel, and again think, but, through the connexion which during his lethargy has still continued to take place between successive changing forms of matter, sense, and mind, so feel his sensations and his thoughts revived, that the new sensations shall only appear a continuation of the former ones; that his identity shall not seem disturbed; that all his former recollections shall resume their empire; that he shall at a later period, on awaking in France, with spirits exhilarated, with faculties refreshed, still only appear the same person who a few hours before, with spirits harassed and depressed, lapsed in sleep and torpor in England. And what should prevent, after the greater decombination, the longer sleep of death, of the elements that here have been decombined, that hence have fled, on another globe, the recombination from taking place, the consciousness from reviving on a greater scale than before? What should hinder that not only of the different genera, and of the different individuals of each

genus, that have here and on other second rate globes been decombined, the elements, again reunited in a single individual, should in that single entity revive recollections of the past fate of all these different prior entities, and should form anticipations of its own future fate, infinitely further prolonged, more extensive, more poised, more perfect, more protected against accidents and evil, than any that can take place at the present period, and on the present globe. Thus would, through dint of that very change in matter which we call its perishing—through dint of that very decombination which we deplore,—matter and mind be led to a recombination more perfect, more lasting, more desirable than any which we could on any good grounds expect, supposing mind to have no attributes in common with matter: and not only reason, analogy, every inference we can draw independent of the words of Scripture, assure us that this will be the case; but the very words of Scripture are a warrant for this species of immortality.

The New Testament does not after death here promise us hereafter a soul unconnected with matter, and which has no connexion with our present mind: a soul independent of time and space. That is a fanciful idea not founded on its expressions, when taken in their just and real meaning.

On the contrary it promises us a mind, like the present, founded on time and space: since

it is, like the present, to hold a certain situation in time, and a certain locality in space. But it promises a mind situated in portions of time and of space different from the present; a mind composed of elements of matter more extended, more perfect and more glorious: a mind which, formed of materials supplied by different globes, is consequently able to see further into the past, and to think further into the future than any mind here existing: a mind which, freed from the partial and uneven combination incidental to it on this globe, will be exempt from the changes for evil, to which on the present globe mind as well as matter is liable, and will only thenceforth experience the changes for the better, which matter, more justly poised, will alone continue to experience: a mind which, no longer fearing the death, the total decombination, to which it is subject on this globe, will thenceforth continue lasting and immortal.

As to the attribute of time not continuing hereafter the base of these changes hitherto all founded on time—as to time ceasing, though these other changes to which time is requisite continue—as to space continuing to exist, and ourselves continuing to exist, even in another world, in space, and not continuing to exist in time—as to some individuals who yet continue to exist in other respects, no longer continuing to exist in time, while others still do, these are all things which we cannot conceive, and therefore cannot reason upon.

CHAPTER XXIV.

Further observations on the nature of mind.

HAVING thus tried, and I hope succeeded, to do away the great objection to the doctrine of mind arising out of matter,—a doctrine chiefly founded on the fear of mind being thereby less secure of immortality,—I shall only hastily touch upon the lighter reasons for supposing that mind does not, like sense, originate in matter.

Mind has been thought to differ from sense, and consequently from matter, because, while, of all sensations of the sense more partial and complex than those of mere time and space, we strongly and clearly feel the collocation in certain portions of the sensations of time and space themselves, we do not so strongly and clearly feel the collocation of all the ideas of the mind, later and more complex than those of time and space, in certain ideas of time and space: because, while, of the points of time and space in which are only received sensations of the sense,—being immediately connected with the more external points of time and space, from whence come the impressions which occasion those sensa-

tions,—the outline, extent and locality are by these other sensations distinctly and definitely marked, of the ideas of the mind, separated from the impressions and sensations of the body by an interval of time and space of which we have no perception, the outline, extent and locality are, by these other sensations, less desirably marked and perceptible, and only in general appear, the one later and the other more internal than those points in time and space, in which arise the external sensations which precede and surround them; and because, compared with certain immediate sensations from without, certain ideas of these, such as those called comparisons, discriminations, abstractions and generalisations, of time and space occupy portions so short and so minute, that we do not take them into account at all.

But still even these ideas like all former ones, and like the sensations of present objects out of which they proceed, themselves, when analyzed, are found to have their different component portions successive and simultaneous each placed before or after, above or underneath, to the right or the left of certain other portions of the same attribute; and thus are found to occupy certain portions of the idea of time and space, as well as to hold a certain situation in real time and place.

Mind has been thought to differ from sense,

because, while we feel that sensations, always coming directly from impressions from without, correspond visibly in their locality with the locality in time and place of the external objects from which they directly come, ideas, only coming from these impressions through the medium of intervening organs in the body, often, in the order in time and place of their component parts no longer correspond with the order of these impressions received directly from without, and with that of the sensations directly received from these impressions in the external sense: as they no longer do in images and fancies.

But this is only because in the body, the channels through which impressions first received from without in the organs of the sense produce in the mind actual sensations, afford them time and space to receive in both a new relative order before they reach the seat of those sensations. It is only a difference similar to that which may exist between the music directly by the external hand performed on an instrument, and the different music by an internal mechanism produced on the keys of the same instrument. The sounds still are the same, but the relative order and combination of these sounds is different.

The more thus we think, the more, on the one hand, the reasons for disbelieving that the faculties of the mind arise out of those of the sense

fall away, and the more, on the other hand, the reasons for believing that the faculties of the mind do arise out of those of the sense gain strength. We believe the faculties of the mind arise out of those of the sense, in the first place because they still resemble these former so much that while asleep in our dreams, or while awake in deliria, and even without delirium in those creations of the mind, which have arisen so long ago as to make us forget what in them is mere recollection, and what image, nay, even in sensations more recent, which we receive when we very suddenly in rapid alternations open and shut our hands and eyes, we confound what part of these sensations comes immediately from impressions made by external objects on the sense, and what other part are only recollections of such impressions prolonged in the mind. In the second place we believe that ideas still have a common origin with sensations, because they still are affected by the same external changes and modifications in matter by which sensations of the sense are already affected—accidents, opium, intoxication, ague, fever, age, weakness, disease, indigestion, dyspepsia, bile, too much or too little blood determined to the head, phlebotomy, purging, and whatever else affects the body and the sense, also affects the mind: — because in the same way as in the body and the seat of the sense there are various organs evidently serving for

different purposes, there are also in the brain, in the seat of the mind, organs as various, as justly proportioned to the faculties of the mind, and as entirely arising out of the prior and more external organs of the sense and of vitality, as those of the sense and of vitality themselves in their turn do arise out of prior more external elements from without; and because, unless these organs of the brain serve as instruments for the faculties of the mind, they seem to answer no purpose whatever.

At the same time I do not believe that Gall has yet exactly ascertained in which peculiar organ of the brain resides each peculiar faculty of the mind; because he could not have done so without also ascertaining how the different faculties of the mind are connected with each other, and without becoming a good metaphysician; whereas he seems to have been a very bad one; and to have on every occasion confounded with dispositions of the sense, dispositions of the mind, and with the effects of radical and generic defects, the consequences only of later and more superficial disturbances.

Since we have shown that as soon as in animals, to the faculty of feeling,—of receiving sensations and consciousness of impressions directly coming from without, and produced by the contact of external objects and modifications,—are added recollections of such, no longer derived from the actual contact of external ob-

jects, but, even in the absence of these, continued or resumed by the continuance of the impressions they still, after themselves departing, leave in the body, it follows of course, that in the earliest and simplest of animals in which to actual sensations of impressions from without are added recollections of such from within, are already to faculties of sense also added faculties of mind.

CHAPTER XXV.

Nervous system.

I HAVE in the preceding chapter either expressly stated, or at least must have given room to infer, that of the blood, from within the animal system driven out, a part was with part of the elements from without pressing on and taken into that system, immediately under its epidermis and near its surface combined into a new fluid called nervous, of which a part was again solidified into the first and most external orifices of the organs of sense.

That only on the muscle, from which the blood, after first partly forming this muscle, again partly flowed out, partly from this blood flowing out, and partly from external elements flowing in, was formed this nervous fluid, consolidated into these external orifices of the organs of sense.

That according as on the muscle, with blood from within flowing out, by the suction of that muscle, were combined elements from without of peculiar sorts, these organs of sense themselves became organs of different species:—of mere touch, of taste, of smell, of hearing or of sight, and thus capable, when matured, of experiencing sensations of these different senses.

That of these organs of sense the first origin and most external parts were not nerves, or elongated tubes; since nerves are only later vascular organs or ducts, again arising out of prior cellular organs or glands, and again conveying the fluid, first forming those glands, through them to a further distance; and since faculties of sensation already appear in animals in which no nerves yet are found to exist.

That we therefore do better in calling both the organs in which are the roots and foundation of faculties of sensation, and those later prolongations of them, in which sensation actually arises, papillæ, as being a word expressive of very minute glands.

That these organs of sense—these papillæ—first began, not from the inside of the animal frame and so as to grow outward; since the origin of the sensations themselves begins from the outside of the body and grows inwards; since it is contrary to analogy that the first elements of peculiar organs should come from a quarter opposite to that from which come the forms in which their faculties are first felt; since organs of sensation only first were capable of arising out of the same fluid whose later and greater influx afterwards awakens them to actual sensation; and since there are animals who already have sensations without showing any internal focus whence any organs of sensation sprout outward.

That in certain animals, by greater suction

from within, and greater influx of elements of sensation from without were, in the organs of sensation, on the faculties of receiving by a preponderant proportion of the elements from without, sensations of external objects, again founded later faculties of receiving, from a preponderant proportion of the elements or blood from within, later continuations or repetitions of these sensations from without, in the shape of sensations from within, called no longer sensations of sense but of mind,—no longer sensations of impressions from without, but recollections of such impressions from within.

That the internal seats or organs of both sorts of impressions are the same; that the organs themselves, formed of the same sort of elements, are the same; that the impressions are of a similar sort; that the difference between those sensations that come directly from without, under the name of sensations of external objects—of impressions of the sense—and those that come from within, under the name of ideas from within—of recollections of the former impressions—of impressions of the mind—lies in this, that in the nervous fluid producing the former, the elements from without preponderate, and that in the nervous fluid producing the latter—but which in the organs of sensation can only be produced, after the former have matured them for the same—the elements or blood from within preponderate.

That while from without the influxes of ele-

ments causing actual sensations of external objects, or from within the influxes of blood causing recollections of these, are in such moderate quantities, and so proportionate to each other, as to benefit the organs of sensation, to increase and invigorate them, and to produce in them orgasm and protrusion, the feel of these impressions is pleasant.

That when in the organs of sensation from without, and of thought from within, of elements causing actual sensations of external objects, or of blood causing recollections of them, the influxes are in such immoderate quantities, and so disproportionate to each other, as to injure, to enfeeble and to decompose these organs of sensation and thought, and to produce in them depression and shrinking, the feel of the impression becomes irksome.

That while the influx from without or within, in the organs of sensation and thought, from being proportionate, and producing in the organs a present sensation from without, or a recollection of such sensation from within—a sensation of sense or of mind—pleasant, it also produces in the organs a fulness, an orgasm, a protrusion, an ebullition outward, it also produces, with the recollection of the agreeable sensation, a subsequent efflux outward, tending to favour the further combination with more elements from without, and thus to promote the further continuation or renewal of the pleasant sensation from without.

That when, on the contrary, the influx from without or from within in the organs of sensation, from becoming disproportionate, it produces in the organs a present sensation from without, or a recollection of such a sensation from within, disagreeable, it also, at the same time, produces in the organs an exhaustion, an emptiness, a shrinking, a suction of elements from without excessive, to re-establish the proportion, it moreover produces, together with the sensation disagreeable and irksome, a depression, a closing of the organs to further elements from without, tending to shut them out, to prevent their further admittance, and to stop the further disagreeable sensations of external objects, which their admittance would have caused to continue.

That this tendency, by the cause of first impressions from without, and of recollections of such from within, either to continue or renew them, or to discontinue and not to renew them, produced, forms in the mind the one a desire, and the other a fear, and either indistinctly a will; and that the cause which produces internally in the mind this will, produces externally in the body voluntary actions agreeing with the same.

That where in animals, as in zoophytes, there only exists an external surface exposed to air; where there exists not yet, in the shape of an alimentary canal, any internal cavity, or surface,

or gulf, exposed to a ramification, a branching off, or partial later stream of the same air, diverted from its general map, there cannot yet, in addition to the external papillæ of the sense, by means of blood driven out be, with aerial elements sucked in, formed any internal papillæ of sense of any sort.

That where, in addition to the external surface, exists such an internal cavity, by the aerial elements penetrating in this cavity, and by the blood exsuding from the same, papillæ of sense capable to receive sensations of impressions made on the coats of these cavities will arise.

That in the simplest animals of the vital insentient parts, composed of fewer different elements, the elasticity and suction still was insufficient to cause the papillæ of sensation, by the blood from within with elements from without, combined, to elongate in nerves inward, which might carry their sensitive extremities farther inward, nearer to, and more in immediate contact with each other.

That in these animals consequently the papillæ of sensation must have the seat of their sensation still remain fixed immediately under the epidermis, near the external surface, far removed from the seat of actual sensation of the other nearest papillæ, and without any immediate communication with these latter; so that in a single vital aggregate of this species, there still must exist as many aggregates, vital and sensitive,

distinct and separate from each other—as many individuals, sensitive and mental, that have no immediate connexion—as there may be spread near the surface distinct glands, or papillæ, or foci of sensation, thought, will, impulse and action outward of a voluntary sort, distinct and separate from each other.

That in simpler animals that same want of elasticity and suction, necessary in order of the papillæ of sensation to produce the elongation into nerves inward, and of their impressions the concentration in a single focus, which prevents that concentration, must consequently also of these impressions, and of the recollections of them, prevent the later impulse outward, from proceeding from a single focus.

That as in simpler animals only from the same want of elasticity and suction, necessary to produce vital parts very spreading and very diversified, and wanting further influxes very various to support them, could also arise in the papillæ of sense the want of elongation in nerves inwards, necessary more to concentrate their actual impressions, and sensations, and recollections, and wills, which were again to impel to connected corresponding actions outward, this want in these animals of that elongation and concentration of those papillæ could not in them signify and become detrimental.

That in these animals the mere connexion of

their vital insentient parts on which the papillæ of sense must be superstructed, would, between the impulses outward produced in the latter, ensure a sufficient accord and harmony.

That in animals in whom a greater elasticity and suction of the vital parts made them sprout out in extremities more diversified, this greater elasticity and suction would also on their muscles cause the papillæ more different again constructed to elongate and to sprout further inward into ducts called nerves.

That this greater suction would there leave the first glands or papillæ, constructed at the surface of the body, as it were only in the capacity of mere roots or bulbs of the organs of sensation; and would cause these roots to elongate inward in stalks called nerves, and that only where these nerves would inside terminate, would arise at the termination of these glands or papillæ the seat of actual sensation, recollection, sense, mind, ideas, wills, and impulse to voluntary action: which thus, from being spread near the external surface of the body, became transferred to, and concentrated in its interior.

That if through the greater elasticity and suction of the frame, this frame had been made to the external surface to add an external alimentary canal, on the coats of this canal the papillæ again superstructed would naturally be prolonged in nerves inward advancing in a sense

opposite to the direction of the nerves from the external surface advancing inward; and which in a certain sense, and to a certain degree, would advance outward.

That these nerves, from the external surface advancing inward, or those from the internal coat advancing outward, would not be fibres of a solid nature, only transmitting mere vibrations; inasmuch as such vibrations could not be effectually produced in organs having so little tension, and so circuitously led through the vital parts as we see nerves to be, but must be tracheæ, ducts, tubes, which, originating in the earlier bulbs outside, through these carry the nervous fluid, similar to that which first formed them, further inside, and at their inner extremity first form the glands, which actually receive the faculty of being by further influx of similar fluid made to feel.

That each external bulb or root of a papilla of sensation, of the mixture of a distinct portion of blood from within and elements from without formed, would in its turn form inward a distinct stalk, stem or nerve, and at its inner end a distinct blossom or papilla of actual sensation; and that what we perceive as single nerves inward are only nervous cords or fasciculi, each composed of numbers of nerves, beginning and ending separately, and only in their intervening course athwart the vital parts pressed together.

That at the point where, from each opposite

side of the external surface of the body, the nerves, carrying the nervous fluid more inward, met and arrested, and were themselves in their turn met and arrested by the nerves made to do the same from the opposite side, would be formed these papillæ terminating them, so that in the centre of the body should, from distance to distance, be formed pairs of conglobate glands or seats of sensation, thought, will and voluntary reaction outward, proportioned in number to the length of the body, and called ganglia.

That where from each opposite side of the internal coat of the alimentary canal the nerves, carrying the nervous fluid more inward, and there forming the later internal actual papillæ of sensation which terminated them, were arrested by obstructions from without, they should likewise form a conglobate gland of actual sensation, thought, will and voluntary reaction on this alimentary canal, also called ganglia. That, while the ganglia from opposite sides without formed more inward, and called, rather prematurely, spinal ganglia, since they are formed prior to the formation of the ossous sheath called spine, should appear, by converging, so close wedged as always to appear in pairs, the ganglia from opposite sides within formed more outward, and called, also rather prematurely, intercostal ganglia, since they are formed prior to the formation of ossous concretions, called ribs, should

appear, by diverging, so distant as always to appear single.

That where the vital parts sprouted forth in an anterior extremity,—a head,—more complex, the blood from within driven into that head would there, round the external orifices of stomach, lungs,—the outlets of mouth, nose, ears and eyes,—with elements from without, form external roots and internal blossoms or papillæ of organs of sensation more numerous and more varied than were formed over and in the rest of the body; would there form an internal conglobate gland or pair of ganglia, consisting of papillæ more numerous, more varied, more extensive than had been collected in any other part of the body, and which is called by pre-eminence, brain.

That not only from the nervous fluid from without driven inward would, within, be formed ganglia and brains, and in these ganglia and brains sensations, thoughts and wills, but by the excess of this nervous fluid, again arrested and driven outward, would be formed other ducts or nerves, again carrying that fluid outward into the muscles, or again drawing that fluid already in them again out, and thus causing in that muscle by its influx orgasm and protrusions, which would make them seek further influxes and impressions from without, or, by its withdrawing former influxes from these, causing in them depressions

and shrinkings which would make them avoid, and close against, further influxes and impressions from without.

That as the elasticity and suction from without became greater, and drew more elements and saps from without inward, this suction would also cause more new nerves from each ganglion to shoot forth to each other ganglion, between the ganglia from the surface without under the name of spinal cord, and between the ganglia from the alimentary canal within, under that of sympathetic nerves.

That while the superfluous nervous fluid, from each ganglion flowing outward to the surface, would cause an external voluntary reaction analogous to the prior sensations from without, the superfluous nervous fluid from each ganglion flowing through the sympathetic nerves to each neighbouring ganglia would cause in that neighbouring ganglion a participation in the sensations produced in the former internal ganglion.

That as the pair of cerebral ganglia called brain, from the number and diversity of the papillæ of sense of which it was composed, preponderated more in size over the other ganglia, it would also, through its ducts of communication with these, rule them more.

That as the papillæ composing the ganglia called spinal, and particularly those composing that extreme one called brain, were more approxi-

mated, they would shoot forth not only in more ducts outward to the external surface, but in more ducts inward to each other, so as to enable the cerebral fluid to be more from one driven to another, and thus, of the elements of perceptions from without and recollections of such from within, to present a greater number collected in a single aggregate of sensations and of recollections.

That as of the papillæ more numerous and more varied forming that extreme pair of ganglia called brain, many nerves, impelled outward, would again from without, by the resistance and counterpressure they there met, be resisted and made to turn inwards, and in the brain revert to the papillæ nearest those from which they issued, and thus establish between those papillæ internal channels of communication, through which the nervous fluid might pass internally from one papilla to another in an order in time and place different from that in which it was made from without to affect these papillæ in impressions coming directly from external objects, and in recollections of such; and might thus be enabled to form internal pictures, in the order of their component parts different from that of mere sensations and mere recollections of such, and called individually images, or discriminations and comparisons between different recollections and images.

That as the brain acquires more size and more energy, it would by greater suction draw more of the fluid from the inferior ganglia to itself; render these inferior ganglia smaller and weaker in their faculties, increase its own superior size and preponderance more and more, be able to govern the sensations, will and reactions of these inferior ganglia.

That in some animals the ducts or nerves in the brain would so increase and multiply as from concrete thoughts representing the whole of certain impressions, in what they resembled, as well as in what they differed from other concrete thoughts, to drop the resemblances, only to retain the differences, and thus, out of pictures of individuals to form pictures only of genera, different from each other.

That after a certain time, during which external elements continue to flow, and to produce fresh sensations of objects from without, while former elements from without flown in before, produce, mixed with these, later ideas of the mind, either by the elements from without ceasing to flow, as at night do those of light, or by the external outports of the organs being themselves so exhausted as to collapse, to close, and to refuse the further admission of elements from without, the further entrance of these elements ceases, and the sense falls asleep.

That during that interval of sleep from with-

out, the elements admitted before it began may still, mixed with blood from within, continue to produce sensations from within, called of the mind, such as recollections, images and others, then called dreams, but which, while they continue to be felt exclusively, and thus betray not their want of connexion with the sensations from without, are discovered not to proceed immediately from external objects.

That in simpler animals, possessing only papillæ of sense separate from each other, if they have any dreams, as some may have, these dreams, necessarily having no connexion in their component parts, and, in the collocation in time and place of these component parts thus incapable of offering any difference from that of the component parts of any sensations coming directly from external objects, cannot even while the animal is awake be distinguished from such impressions from without, or from mere recollections of such.

That in animals the form, composition, pressure, elasticity and suction of the earlier and more fundamental mere insentient parts must determine the efflux of blood from within, and the combination with elements from without, and the site, and number, and variety of sentient organs superstructed on the muscle, and their collocation either at the surface external, or also at a surface internal of the body, and their being entirely, in their impression inward and impulse

outward, confined to the surface, or by the elongation of nerves formed into ganglia and brains more inward, which become the focus both of the sensation and recollections from without, and of the will and reactions from within outward.

That while in zoophytes the seat of sensation, of thought, of will, and of action outward is spread over the whole body, in actinias and medusas, and other polypi, it seems already more concentrated round the mouth in the shape of feelers called tentacula.

That in mollusca, fast anchored in their shells at the bottom of the waves, which float to them their food; which only require dilatation to receive that food while beneficial and grateful, and contraction and closing when that food becomes injurious and painful; who want not locomotion for any purpose of desire or aversion; who fear not the storm raging around them; who require little feeling, and no sight, their first ingredients are so combined as to produce little of the organs and sensations, of which they want but little.

That in animals like worms, composed of a repetition of vital parts of the same sort very numerous, internally united, and externally presenting a series of articulations, or rings, strung together, each separate vital part would have its separate ganglia, connected with the ganglia of the rest by a spinal cord running through the whole, and enabling the inward impressions made on each part to react on and establish a concert

with the outward actions produced from the other ganglia.

That in animals in whom the earlier and more fundamental vital parts shoot out into a head having a preponderating brain, this brain, by its suction diminishing the power of the inferior ganglia still more, and must more exclusively direct the voluntary impulses and actions outwards of the whole body.

And that even animals having a distinct head, according as they are formed in water, on land, or in air, and want for their future support and increase elements from without less or more rich and varied, will also of these elements receive a less or greater quantity, and thus also receive organs of sensation to perceive these external elements, and organs of voluntary reaction outward to pursue, apprehend, and master the objects whence they proceed, less or more concentrated, and varied, and powerful.

While the mollusca living in water, only for his support wanting to perceive and to let in the nearer elements which surround him, probably has only the sense of feel and of taste, the insect, the bee hovering in air, forh is support wanting from afar to perceive and to approach the distant flower, is already endowed with organs of smell very fine and very ample for the purpose of scenting those flowers, and wings very spreading for that of wafting them to these.

CHAPTER XXVI.

Further proofs of certain of the foregoing statements.

That blood from within the animal frame flowing out forms a principal portion of the nervous fluid which consolidates in organs of sensation, appears since only where blood from within meets elements from without in certain quantities such organs are first formed, and since only where blood from within on these organs first in greater quantities meets greater quantities of these same elements from without, these faculties are in these organs first awakened, and actual sensations produced.

That elements from without the animal frame flowing in, and combined with the elements from within flowing out, form another principal portion of the nervous fluid that consolidates in organs of sensation, appears since only where such elements flow in, and combine with blood, these organs are formed; and since as more of these elements mix with more blood, from the mixture arise organs of sensation stronger and more vigorous; and since as organs are less exercised from within, and less exposed to air from without, their faculties of sensation weaken; and since every

organ of sensation takes its origin internally in some substance formed of the accumulation of blood from within, and of some element from without, mixed together, which in the organs of touch is called moisture on the skin, in those of taste is called saliva, in those of smell is called mucus, in those of hearing is called wax, and in those of sight is called vitreous humour, and nourishes the organs, and of which the want leaves these organs to starve, to become weak, and to decay.

That the same cause which makes the carcass shoot forth into an anterior extremity called head, and in that anterior extremity makes part of the blood from within attract to it part of the elements from without, also makes at the surface of the face the external materials of the higher organs of sense collect and form these organs, appears since, where these organs are elongated, and only have their papillæ completed in the inside of the head, in that inside also are found certain ventricles in which further blood from within and further aerial elements from without meet, combine and complete them.

That the very attributes, and movements, and pressures of external elements form those organs of sense peculiarly destined to perceive their impressions, appears since, where these impressions, like most of those of touch, only come from external objects in immediate contact with the organ of sense, they occupy the same extent of

space as the organ itself; whereas, when these impressions, like those of sight, come from external objects more distant, they are concentrated and reduced in the eye in proportion to the distance they come from; and, according to that greater distance, objects more numerous each impress a smaller space and fewer papillæ in that eye.

That only according as blood from within is, in different parts of the body differently composed and modified, of the different elements from without pressing round that body those that suit it appear combined with it, since in different parts of the body are formed and fed different organs of sense.

That only, as in the organs of each sense the external elements suited to it are made to flow in certain proportions relative to the proportions of the blood from within flowing out, they cause actual sensations of the impressions from without, appears since only after certain elements from without have flown in in certain quantities, such sensations are felt.

That only where by elements from without organs of sense have been so matured as to receive sensations of them, they are thereby prepared to be by the blood from within awakened to later ideas or recollections of these sensations from without, called sensations of the mind, appears, since only after sensations of the sense have first appeared follow sensations of the mind,

repeating the impressions of the same objects, already represented by the former sensations of the sense.

That only from influxes and impressions of the blood from within arise in the papillæ of sense the pictures of the mind, appears since a lying posture, a fever, or whatever else determines more blood than usual to the head, also favours thought, and renders its flow more rapid and more copious; since, on the contrary, a large meal, which draws more blood from the head to the stomach, renders the thinking powers torpid; since bleeding often suspends these powers entirely, and causes fainting; since too much thought, by attracting and consuming too much blood in the brain, causes, through want of a sufficiency of blood remaining in the vital parts, ill digestion and dyspepsia; and since blood, from which bile has not been sufficiently discharged, often impairs the faculties of thought, and embrowns the ideas.

That in animals it is only a greater suction inwards which makes the papillæ of sense formed near the surface of the body elongate inward, and only terminate their sentient inner extremity at a distance from their external root, appears since in inferior animals, in which there is less of this suction, no nerves are found, while in higher ones, in which there is more of the same, nerves do appear.

That only through dint of the opposite pressure from the opposite halves of the general body of air without, on the opposite external surfaces of the body within, converging inwards and to each other, the roots of the organs of sensation situated along these two opposite external surfaces of the body are made to elongate in nerves or ducts inward, which advance till from opposite sides they meet and arrest each other, and thus internally form together the two distinct lobes of each different spinal ganglion, unto those of that ultimate ganglion, the brain—each found in pairs or double—appears since, through the pressure of that peculiar column of air which, detaching itself from the general mass, ramifies and enters the alimentary canal, and, on the contrary, presses on the opposite surfaces of that canal outwards, the roots of the organs of sense situated along the opposite surfaces of that canal are made to elongate in nerves or ducts outward, only producing over the stomach, lungs, &c. ganglia, called intercostal, which each remain single.

That the same suction from within which in higher animals makes these organs elongate inward, also makes part of the blood from within the body, and part of the air from without that body, be attracted to and meet in the ventricles in which the inner sentient extremities of these sensitive plants terminate, and to these inner extremities transfer the power of sensation, which

in lower animals began nearer the surface, appears since, in higher animals, from the same cause would proceed both these effects.

That nerves are not solid fibres, but hollow tubes, first formed by, and next conveying onwards, the nervous fluid, which at their inner extremity impresses the papillæ both with sensations of external objects, and with later recollections of such, appears since such is the mode of growth of all bodies arising out of bulbs; since Brodie has discovered that, even where nerves are divided, the nervous fluid continues to flow from one part of the divided duct to the other uninterrupted to a certain distance, and to carry sensations to the brain; and since only the flow of a fluid through the nerves of the brain can account in children for the formation of new ideas being accompanied by a sudden glow in the seat of the mind; for the mathematical calculations often performed by young people without knowing by what process; for the natural and regular attributes of external objects, which produce, and which are retraced in the distribution of the ducts of the brain, being by them remembered, when the arbitrary names attached to these attributes are forgotten; for the flow of ideas being at one time unaccountably stopped, in spite of the greatest efforts to keep it up, and being at another time as unaccountably continued, in spite of the greatest efforts to stop it; for one part of a recollection accidentally kindled reviving

another; for association of ideas; for ideas in minds still young, in which the cerebral fluid still flows rapidly, following each other with such ease, and in minds become old and stiff, in which the ducts are dry and hard, being often produced and propagated so slowly, and with such difficulty; for ideas long forgotten and laid by, being by a sudden shock and concussion of the brain, which clears ducts before obstructed, often without any external cause revived, and for a million of other circumstances not otherwise explainable.

That in animals the papillæ of sense and those of mind, whether suffered to be individually completed, and left wholly separate from the next papillæ, near the surface of the body, or whether by intervening nerves their sentient extremity be removed to the brain and connected with the sentient extremity of the next, are still the same papillæ; that where the sensitive powers are retained near the surface of the body, the mental powers are so likewise, and that, where the mental powers are removed to the brain, the sensitive powers are the same; that these latter only appear themselves already to reside in the external roots of the papillæ, near the surface and extremities of the body, because the impression from without that causes them begins already from this former point first visibly to affect that body, and because from this point they travel further inward in the order in

time and place in which they are there first received; that the difference between sensations from objects without, and between the later ideas concerning such objects formed within the brain, consists only in the nervous fluid which causes the one being composed of more elements from without, and that which causes the other being composed of more blood from within; and in the organs only being by the influx of the elements proceeding from former first matured for sensations of the impressions received from the latter, appears since we cannot perceive in space a line of demarcation between sensations from without, and recollections of such sensations from within; since sensations flow imperceptibly into ideas.

That if, while sensations of external objects can only be felt in the presence of those objects, and recollections of them can be felt in their absence, this is only because the impressions causing the former sensations, coming directly from the objects themselves, can only come in their presence, and those causing the latter, not coming directly from the objects themselves, but only from fluids carried about with us, may come in their absence, appears since such would be the natural effect of these different sorts of impressions.

That, whether inwardly still terminating near the surface of the body, or whether already at a distance from that surface concentrated in the

brain, the papillæ of different senses, and those of the same sense may be in incredible numbers, appears since a single spark of light, which while motionless only produces on a single papilla an impression equally motionless, may, by being twirled round with such rapidity as to make on different papillæ in turn as many different successive impressions, each beginning before the impression on the former papilla has subsided, produce on the whole the collective impression of a complete ring or circle of light.

Indeed, that, as of each sense each organ, destined to feel a sensation, in part different from that felt by any other organ of the same or of a different sense, must be in part composed of elements from without different from those of which is in part composed that other organ, in higher animals of each sense, and particularly of that of sight, the organs as well of the same sort, as of different sorts, each formed first of an external orifice or gland calculated first only to receive from without the elements causing impressions, next of the nerve or duct inwards calculated to carry these impressions to the ganglion or brain, and, lastly, in this ganglion or brain of the inner extremity, or gland, or papilla, calculated of these impressions to receive actual sensations, or later recollections, and to have these recollections by internal nerves or ducts intermixed in an order in time and space different from that in which

the impressions and sensations of them first came from without, must individually be prodigiously minute, and must collectively be in prodigious great numbers, and must, lastly, be very equally intermixed throughout each separate field of the sense, appears still more evident when we consider that while, on the one hand, we may through each eye receive sensations of the same sort—of the same colour—to a great extent, so continuous as to appear connected in a single mass, we may also, on the other hand, of the different parts of an external object—a prospect for instance—receive simultaneous impressions of sight, each separated from the other by, and intermixed with, other intervening impressions different from themselves, in a thousand different ways, degrees, and proportions.

That in the lobes of the brain of higher animals, the more numerous involutions of the ducts called nerves only arise from these nerves not finding room, any more than do in the body the larger ducts called bowels, to expand and stretch to the full length of their formation, and thus being forced by their integuments to become crumpled up, appears since in hydrocephalus, which mollifies and stretches the skull, the nerves of the brain are also by the pressure outward on that skull made to extend, without the functions of the intellect being thereby impaired; and since, as these involutions, by the amplitude of the nervous ducts, become

more considerable, the animal generically appears to have faculties of mind more varied and comprehensive; and since the lesion of the lobes of the brain may impair the faculties of the intellect, without affecting the faculties of mere vitality.

That dreams are only ideas in the mind, similar to the thoughts produced while waking; but produced while the external orifices of the organs of sense are closed to fresh impressions from external objects; and that they only in their form are often more extravagant than waking ideas, because they are no longer guided and controlled by actual perceptions of external objects, appears since in the nature of their lesser component parts and materials, they still resemble waking ideas.

That what in animals is often named the spinal cord, even before there yet exists any spine, is only the fasciculus of the different nerves, partly from the external root of the papillæ of sense prolonged inward to the ganglia and brain, and partly from the ganglia or brain again prolonged outward to the external muscles of voluntary action, which these ducts, in desires, by pouring nervous fluid in them cause to swell, protrude and advance, and in aversions, by drawing nervous fluid out of them cause to shrink, collapse and close; that only by pressure upon them in their passage athwart the vital parts, these nerves formed and carrying fluids in opposite directions,

appear united, is evident since everywhere the nervous cord appears double.

That, where behind the brain proper is found a cerebellum, this is the ganglion, or brain, or focus of perception, which from the sensitive papillæ, called intercostal, conveys impulse and reaction to the muscles situated over these parts, appears since it holds behind the brain the situation and performs the functions of such an intermediate organ.

That of the influxes from the external surface, which produce sensations and recollections of such, and desires and wills, the recoil outwards in its turn produces effluxes, which, when again reaching the surface of the muscles, in them cause orgasm and protrusion and ebullition of the nervous fluid, appears since desires of external sensations, when strong, are accompanied by peculiar movements in the external muscles, even in the absence of the external modifications which might correspond to these advances, and satisfy these desires;—desires of peculiar sensations of the sense of feel producing orgasm, shivering and ebullition in the limbs and organs in which reside the chief papillæ of feel; desires of peculiar enjoyments of the sense of taste producing watering of the mouth and smacking of the lips; desires of peculiar scents producing dilatations and snuffing up of the nostrils; desires of peculiar sounds of

music, producing an expansion and a pricking up of the ears; and even a desire of peculiar sights producing a tension and gloating in the eyes, beyond what is commonly experienced, and which motions are calculated, where externally exist and are present the modifications, capable of meeting those desires, to gratify them, by combining with these effluxes more copious from within, these influxes from without in a more effectual manner; and aversions in the same way causing, even in the absence of external modifications that are the objects of them, a peculiar shrinking and retraction in the peculiar external organs, which, if the modifications causing that aversion were present, would produce the avoidance of these.

That these effluxes of nervous fluid from the brain, which accompany desires, and stimulate the external muscles to inflate and to satisfy them, really take place, and really complete in the nervous fluid, as in the blood, a circulation first from without inward, and next from within outward, appears since in human beings, of which the wishes or avocations tend to peculiar actions or exercises, the muscles employed in these exercises acquire an unusual swell and vigour; as in singers those of the throat, in dancers those of the legs, in wrestlers those of the arms, in town criers those of the lungs, &c.

CHAPTER XXVII.

Further detail of how, in different animals, according as their first and fundamental vital parts, not yet sentient, have an elasticity and power of suction less or greater, arise on these vital parts organs of sense and mind less or more developed.

I HAVE, I hope, established that from the vital parts of animals flows out blood, which with elements from without is made to be, on the muscle and near the surface, combined in nervous fluid, and in part consolidated in nervous solids or papillæ, capable of taking further similar blood from within, and similar elements from without, in them, till by these later influxes more matured, they are by still further influxes of the elements from without, and by the impressions these make, awakened into actual sensations of them; and when thus matured, even in the absence of further influxes from without, and by mere further influx of the blood from within, and by the impressions this makes, they are aroused into further internal continuations and resumptions of these sensations from without, called recollections and ideas of the mind, and which, though they cannot

begin to be felt except where sensations of the sense have preceded them, can be continued, and resumed, and carried about, after these impressions and influxes from without, that first caused them, have ceased to act. I have, I hope, established, that while the influxes from without are in quantities benefiting the organs of sensation, the sensations of them are pleasant; and that while the influxes from within are in quantities benefiting these organs, the recollections of them are pleasant; that while the influxes are in such proportions as to render the sensations and recollections pleasant, they are also in such proportions as to cause an efflux backward and outward to the muscles, productive in these muscles of a swell, an orgasm, and an efflux which, where more of the elements from without continue to hover round, causes a new suction of, and combination with, and impression by these; and that when the influxes of elements from without, or of blood from within, become so excessive and disproportionate as to cause the sensations or recollections to grow painful, they cause in the external muscles, with which the organs of sensation communicate, a retraction, a withdrawing, a suction upward and inwards to the brain of the fluid already in them, in order to supply the deficiency, that causes the organs of sense, superstructed on these muscles, to shrink, to collapse and to close against fresh

influxes from without of the same elements, before grateful, even when these continue from without to flow to the body; that however much the influxes from without may, by their excess, render the actual sensation painful, while the influxes from within, causing the recollection of these sensations, are moderate, these recollections of them remain so pleasant, that we often are detected dwelling with pleasure on the memory of sensations which were in themselves productive of pain. I have observed that the actual sensations of external objects are no longer the objects themselves, but only effects of the impressions they leave; but that even later recollections of these impressions still intrinsically are realities; that both in present sensations of external objects and in later recollections of these sensations, the instruments on which the impressions are made are the same; that the impressions caused, the one by somewhat more elements from without, and the other, somewhat later by somewhat more blood from within, are in substance similar; and that the sensations arising from the latter still strongly resemble the sensations arising from the former.

I shall now resume, advance and extend my inferences. I shall first repeat, that in the vital parts of animals least exceeding those of mere vegetables in elasticity and power of motion, not only the earliest and most external, but the later and more internal half of the organs or papillæ

of sensation, thought, desire, aversion, will and impulse outward to the muscle to perform actions corresponding with the desire, or retraction from the muscle without, of the fluid necessary to keep the organs of sensation open to further influx of external elements, are still both alike formed near the surface external and internal of the body, and at a distance from the interior of the frame, and distinct from the other neighbouring organs of the same sort contained in the same frame; and thus in that single vital aggregate or frame still form a number of individuals, sensitive and mental, distinct from each other, which, however, by the unity and connexion of the vital aggregate on which they are grafted, and by the little variety in the position and offices of its different parts, fully suffice to lead to perceptions, thoughts, inclinations or aversions, wills and impulses outwards, tending to the general benefit and enjoyment of that whole aggregate.

The organs of vitality more elastic, and endowed with greater powers of suction, of other animals, would make their papillæ of sensation and thought inward, and of corresponding desire, aversion, will and action outward, only leave their first and fundamental roots near the surface of the body, and cause these roots to elongate in nerves inwards, which would carry their inner extremities, actually capable of sensation and of thought, further from their outer extremities, and

from the surface of the body, and nearer to and more in contact with each other, and more anastomosing together; and would in their turn also cause the nerves outward, by the recoil and efflux of the fluid from these former nerves inward produced, also to go outward to a greater distance, before they again reached the external muscle, on which the external outposts of the organs of sensation rested; and thus would, when the organs of sensation were matured for actual sensation and recollection, and desire and aversion, and will and impulse inward and outward, from the circulation of the nervous fluid to and from a focus of papillæ more numerous and more concentrated, arise, first an impulse first to sensation inward, and next, an impulse to voluntary action outward, also more extensive and more concentrated.

In sleep, when no sensations from without can be continued, recollections of former sensations from without may be continued in the shape of dreams. Dogs and parrots must have powerful recollections when, in their sleep, the former bark, the latter prate. The faculty, residing in certain organs, and in certain portions of the nervous fluid, of recalling the impressions, before having caused sensations from without, in the shape of recollections of these sensations from within, is itself termed memory, and, as, in organs of sense, recollections of sensations from without are by the nervous fluid more easily revived, and last longer, the memory is said to become more tenacious.

In other animals organs of vitality still more elastic, and endowed with powers of suction still greater, would make the internal halves of the papillæ of sensation and mind, thus pressed close together, sprout out in nerves of communication between them, through which the nervous fluid might run, and might cause, of the sensations received from without, later recollections, in an order in time and place different from the order in time and place in which these sensations first came directly from external objects, and in which later different order they are generally called imagination; though, as that word confounds the faculty of producing these new pictures of the mind, residing in certain organs, with its manifestation in actual peculiar individual instances, I shall reserve the word imagination for the faculty of producing such pictures, and for the individual pictures themselves, substitute the word image.

Images are only resumptions of prior recollections, no longer in the mind having their lesser component parts presented in the precise order of time and place in which they first out of actual sensations of the sense arose in the mind. In an actual sensation of external objects we see a human being and a lion distinct and separate. So we still do in a mere internal recollection of these sensations from without. In an image we may see the human head placed immediately on the body of a lion. We may see

the cart before the horse. We may see the event which in reality preceded another event as posterior to that other.

In the young minds of children, images, formed without design, and by the mere exuberance of the nervous fluid made to wander through the first ducts that between the papillæ of sensation and thought present themselves in its way, will precisely be the most crude, the least composed with intention and method, the most unlike the sensations of actual impressions received from without, and the recollections of such;—ships sailing on dry land, cities floating on the sea; beasts with the faculties of men, men with the limbs of beasts.

Yet even these, when summoned up in the mind during sleep, and in the absence of actual sensations from without, with which to compare them, and to show the difference they present, will themselves pass for such sensations from without, and by the effluxes toward or retractions from the muscle outward which they cause, make us feel desires or apprehensions.

Even awake, when the rush of blood from the body to the brain is so great as to cause delirium, or when in the brain itself there is a circulation ill conducted, the images most unlike sensations of external objects, will, by their intensity, often pass for such actual sensations or perception of external present objects.

When in the mind arise ducts more numerous, and when that mind is more accustomed to receive sensations from, and to entertain recollections of past impressions from without, the images in the mind will themselves by habit become so conducted as more to resemble recollections. We shall form images of things past, never actually beheld, more resembling recollections of things past actually beheld; of things future, of which all pictures in the mind must be images, we shall behold images, more resembling recollections of things past actually beheld; and actual sensations from without, recollections of former sensations from without, and images may, in the organs of sensation and thought capable of receiving them, by degrees arise intermixed with each other. Even of external objects already gone by, or not yet come—past or future—the images, however, while they arise, themselves are present. A picture is in itself a present reality, though it be the representation of the first creation of man, or of the last judgment.

In other animals, of the vital parts the still greater elasticity and suction, producing in these vital parts themselves a greater variety, and requiring a greater discrimination in the sensations to be sought for the benefit of each part in particular, would with the new want also produce its new remedy. It would produce nervous ducts able to separate certain recollections and images

from certain others: to mark in what attributes they, and the external objects which they represented, differed from each other, and in what attributes they resembled each other;—to form discriminations and comparisons.

Discriminations, or the sense of difference, must precede comparisons, or the act by which attributes, felt to be different from each other, are not only recognised in what they are different from each other, but also considered in what they again may resemble each other. Nothing can be compared with itself; nay, can be thought either unlike or even again like another thing different from it till it has first been felt to be different from that other thing. Discrimination, or the sense of difference, must thus first arise involuntarily and unintentionally, before comparisons can arise, and can produce a more minute and detailed sense of what other different things only are different, and what other things, though different, again resemble each these former. All things, though different in their more superficial qualities, must resemble each other in their shares in certain more fundamental attributes, such as time, space, quantity, size, number, of which they each must possess certain portions; or in certain later effects, such as of pleasure or pain, heat or cold, of which they each may produce certain portions; and it is in these only that they can be found to resemble each other.

In their peculiar intermediate intrinsic attributes themselves they can only differ. A taste, a smell, a sound, a sight, each only individually are what they are, in those attributes in which they each differ from the other.

The sensation of difference between attributes and objects is produced by the sensations, the recollections and the images of them, being by the nervous fluid simultaneously summoned up, so as to have these differences perceived, and the sensation of the similarity between attributes and objects is produced by the sensations, the recollections and the images of them, being by that nervous fluid summoned up, so as to have the portions they each occupy in the sensations and ideas of the common attributes of time, space, quantity, &c. or the portions they each produce in the common effects of pleasure or pain, or others, through each other compared, and measured, and felt to fall short of, or to exceed, to resemble, or to differ from those of the other.

In human beings the ducts, necessary to form comparisons, are so numerous, and the cerebral fluid that forms these comparisons is so exuberant and so active, that often children, particularly in the higher human tribes, already for the mere pleasure derived from the act, form comparisons, without end as without object.

In the vital parts of animals, that same superior

elasticity and suction that, for their benefit, would require and produce greater faculties of discrimination and of comparison, would also require and produce greater faculties of option, of preference, and greater liabilities to indecision, to irresolution. From the papillæ of sensation and of recollection, of desire, of aversion, of will, and of impulse outward to voluntary action, would arise ducts through which, if these ducts could not all be impelled to action at the same time, —if the action of some impeded and obstructed the action of the others,—by the nervous fluid only those in which that fluid rushed with most vehemence would be impelled to immediate action, and by that rush the more feeble rush through the others be postponed or prevented; or, where the rush through two or more nerves, whose action was incompatible, was begun, that rush would only produce a real external struggle and conflict, and an apparent external inaction and repose, lasting until the efflux through one of these nerves outward had got the better of that through the others, had entirely subdued and quieted these other nerves, and had alone reached the outward muscle, and in the same produced a movement corresponding to the impulse from within.

This state of internal irresolution, suspense, and conflict, while it lasts, is so far from being a state of repose, that nothing worries the mind

more than the option between two actions between which it cannot decide. This doubt always fatigues and distresses the mind, and often, when very harassing, by the flux of nervous fluid from within which it begins but cannot bring to a conclusion and vent, distresses even the external muscles of the body, as we see by the trembling, the truncated movements, the contortions, the dancing about, the seesaws, the races to and fro, in the muscles of the body by it produced, and the evident relief which ensues, even when a resolution, which we know to lead to an action unpleasant in its later consequences, has at last gained the victory.

We cannot have a certainty of any sensation which we receive being a sensation derived from a peculiar earlier and more external cause. When through my sensations of feel and of sight I am made to believe that holding my finger in the flame of a candle produces in that finger the sensation of heat, and the pain of a burn, this is only a belief. The whole may be a dream.

Still when the nervous fluid has, by running often through certain ducts to certain papillæ, caused in these papillæ certain sensations, and certain recollections of them to follow certain other prior sensations and recollections so closely, as to enlarge the communications that lead from the former papillæ to the latter, and to cause the nervous fluid to run from the one to the other

spontaneously, it produces associations of ideas; and when these associations are formed irresistibly—when we cannot withstand the impulse that with the idea of some entity or event connects the idea of some other peculiar entity or event, these associations of ideas grow into positive beliefs, that the external objects or events which produced these associations are themselves connected; that certain of them produce the others, or arise out of these others.

A dog who, taking possession of a piece of meat, has experienced a pleasant taste, will, when he again sees a piece of meat, connect with the idea of taking possession of that meat the image of a pleasant taste; expect such a taste, and be tempted to take the meat. When after taking it he has been whipped, he will with the idea of the prior pleasure resulting from the act, connect the idea of a later pain following that pleasure, and with the idea of the future pleasure resulting from a future similar act, also connect the idea of a future similar pain. If the idea of the pain preponderates over that of the pleasure, he will resist the temptation, and leave the meat untouched. Thus arise from sensations and recollections of prior actions, beliefs, expectations, and from these consequent impulses to produce or to avoid such actions in future.

When through the nervous ducts, through which certain ideas were associated, the nervous

fluid ceases to flow, these ducts, before widened and strengthened, may again shrink and wear away, till by impeding the circulation of the fluid through them, the associations of peculiar ideas cease, without any other ideas contradictory to, and incompatible with them opposing, superseding and taking their place; but even before their natural extinction, if through certain ducts arise beliefs, founded on associations more extensive and minute, which no longer leave room for the former, the nervous fluid may in forming these new beliefs so impede the continuation of the former one, as, from mental certainties to make them dwindle into doubts, and ultimately change into positive disbeliefs.

Thus the external causes of sensations first produce recollections; of the materials of these recollections the recombinations produce images, these images produce beliefs, and the preponderating of certain beliefs over certain others again produces doubts and disbeliefs of the external existence, reality and truth of what we first believed.

In human beings the slightest associations of ideas, as long as not counteracted by other associations of ideas stronger and more irresistible, will produce beliefs. As these beings grow up, those beliefs will again be counteracted and destroyed by other beliefs stronger and more enduring, and which, of the external reality of the

things represented by the former, again produce later doubts and positive disbeliefs. Children, and savages, who always remain children, and the lower orders, who always remain in some respects savages, are very credulous: they believe many things of which the more mature comparison of ideas produces a doubt or a disbelief. As men grow older, experience more, and reflect more on what they experience, ideas, even by good reasons before proved to be just and true, are by later reasons, still better and stronger, again proved to be unfounded and fallacious. Man only judges of the truth of another man's beliefs by the strength of his own.

There is a vast difference between a mere want of belief in a thing, which want only arises from the idea of that thing not yet being associated with that of another thing regarded as certain; a belief in it very faint, and arising from an association very weak with another thing regarded as certain; a belief in it very strong, arising from an association very extensive and very powerful, with another regarded as certain, a doubt between the belief in two or more things incompatible with each other, but which is founded on associations with both which, whether weak or strong, are of equal strength and extent; and a positive disbelief in one thing, which only arises from a stronger belief in another thing, incompatible with that first.

Some men have, for want of the ideas or

images of certain things being associated with those of certain other things, regarded as certain, a mere want of belief in those things, where others have a belief in them, others have a doubt between the belief in them and an equal belief in other things incompatible with them, and others again entertain a positive disbelief in them.

The beliefs conceived in youth, while the organs still are ductile and pliant, and still with ease, in consequence of slight associations of ideas, conceive beliefs, which are cherished and confirmed as the ducts grow more matured, more firm, and less liable to change, are beliefs seldom again weakened and dismissed when in old age, the ducts, become inflexible and stiff, resist circulation of fluid and associations formed thereby new and different, even when proceeding from data more extensive and more nicely poised.

Thus it is that of ghost stories often repeated, and of superstitions strongly impressed, in early childhood, the belief still often remains firm in the imagination of man matured, even after his expanding reason has begun, when leisurely consulted, of their truth to entertain a doubt, or even to conceive a positive disbelief.

And when interest is on the side of a belief, and makes one anxious to resist the influx of another contrary belief, even where intrinsically founded on a more extensive base, the struggle against conviction becomes from positive desire

still greater, and more certain of ending in victory.

All this, however, does not prove that external certainties do not or cannot exist. It only proves that we cannot of these certainties obtain any certain knowledge; and yet as it seems that our mental organs, and the knowledge which we receive through those organs, proceed from external modifications, the probability is that these beliefs must naturally agree with these modifications; that the mental fluid, by these modifications impelled must, when flowing through these ducts rightly, and unbiassed in its course by impediments and obstructions, lead to beliefs and conclusions corresponding with external realities; and that the more the mind is in its ducts extended and enlarged, and the more, as long as through these the cerebral fluid is rightly conducted, the beliefs in the realities of nature will become not only more numerous and more varied, but more just.

Not only people derive beliefs from those sensations of feel, sight and other senses, which they receive from external modifications independent of other men, but they also derive beliefs from the sensations received by other men, and, through the medium of these other men, communicated to and instilled into their minds. Thus are peculiar tenets very generally made to spread, and dunned in the ears of youth, till they become articles of faith in the minds of age.

When the beliefs in certain things are not prevented by the beliefs in other things, with which they first are regarded as incompatible, we consider the things as possible. When these beliefs become very powerful, we regard the things as probable, or as certain; when the belief in them is again shaken by that more firm in other things regarded as incompatible with them, we call them improbable, and when the belief in them is entirely subverted by that in others, regarded as certain, we call them impossible.

Belief in things grateful begets, in addition to the desire of these things, when they are still regarded as future, hope; and belief in things unpleasant begets, in addition to the aversion which these things inspire, when they are still regarded as future, apprehension and fear.

Let me here, for the better understanding both of what precedes and of what is to follow, again insist on what, I fear, I have not sufficiently pointed out before, as soon as I began, in animals more complex than the very simplest, of the roots of the organs of sense, which always must remain situated at the surface of the body external or internal, whence impressions from without are first to proceed inward, to describe the elongation inward in ducts or nerves ending in ganglia or brains, in which these influxes and impressions from without first of external objects, whence they come, produce consciousness or sensations of, as well as later recollections and

thoughts concerning them, namely, that firstly, since sensations of the sense and later thoughts of the mind only differ in the former already being in certain organs, chiefly by influxes and impressions directly from without, and the latter only being, where the former have preceded and prepared the organs for them, in these very same organs, by influxes and impressions chiefly coming from the blood within, produced, they must alike still only from opposite sides in the very same organs and spot, be each produced; and thus, where the whole of each individual organ of sense and of mind begins and ends separately near the surface of the body, also only both alike be produced near that surface; whereas, on the contrary, where the root of each organ individually presents elongations, or ducts and nerves inward, which cause its internal and sensitive half and extremity to be carried further inward, and to be more approximated to and concentrated with its neighbours in internal ganglia or brains, sensations of external objects and recollections or thoughts concerning such, must alike also only in those internal ganglia or brains be produced; and that, secondly, if, even where the first consciousness and sensation of influxes and impressions from without, as well as all later recollections of and thoughts concerning such sensations, only first takes place in more internal ganglia or brains, the first sensa-

tion and consciousness of these impressions still nevertheless appears to take place in the very roots or outposts themselves of these organs at the surface of the body, through which the influx or impression from outside the body must first enter that body—if we think that of a bruise of the toe the pain is already felt at the extremity of that very toe—this idea is only an illusion proceeding from the impression, which must have travelled to the brain before it could in the papillæ in that brain, of which the outposts are in the toe, produce a sensation, producing that sensation and consciousness in an order in place, so exactly corresponding with the order in space in which we see the external modifications first cause the impression at the surface of the toe; and moreover perceive the internal sensations of that bruise so rapidly following the external impression by which it is caused, that in general we lose sight of the idea of the distance in time and space, which must have separated from the impression made on the external outposts of the organs of sensation, the sensation itself only arising in the internal ganglia or brains; but that, nevertheless, the difference of time and place intervening between the impressions from without, and the sensation thereof within, exists, appears since sometimes it becomes sensible, as when in a man a peculiar external object or even internal thought has already preoccupied

the cerebral fluid and the mental faculties so entirely, as to leave none of that fluid at leisure immediately to attend to and receive consciousness of the new impressions from without, and when consequently, even of a wound received in battle, or of a clock striking in our study, we shall only, long after the impression from without has taken place at the surface of the body, and even must have there again subsided, internally receive the same, the consciousness and sensation.

As to attention paid to a sensation or thought, which causes their impression to be stronger felt, it is only, after the sensation or thought has first been produced spontaneously and involuntarily, subsequently produced by the desire to continue voluntarily to dwell upon the continuation of that impression, and by this desire in its turn, in the external outposts, or internal papillæ of the organs of sense and thought, producing an orgasm and protrusion, which causes them to imbibe more of the external cause of that sensation, or internal cause of that thought.

CHAPTER XXVIII.

Faculties of abstraction or reason.

THE highest mental faculties which I have thus far described, are still only those of producing ideas of external objects, called concrete; that is to say, ideas of external objects in their capacity as individuals, each represented as in their own peculiar component parts, those similar to as well as those different from the component parts of the ideas or representations of other entities of the same or of other different sorts, represented as equally distinct and detached from these other ideas; and of these mental faculties the very highest still are collectively only called instinct.

But there are on this globe entities of which the first and most fundamental vital parts, in which they take their beginning, already composed of the meeting and combination of elements finer and more varied than those of the entities thus far described, as they develope show an elasticity and power of suction of new elements from without, so much greater than any yet described, as, on the organs of sensation and intellect already set forth, to superstruct other

organs of intellect not yet mentioned, but destined, when matured, to evince faculties by none of the organs thus far described yet possessed, which are called faculties of abstraction, or collectively, of reason; and while the entities in whom only can develope the mental faculties thus far described, are simply called brutes, these superior entities receive the name of human beings.

It is easily understood that in these new entities, different from all former ones, the very first organs and faculties different from those of all former entities, were not merely at a later period, only superstructed upon and added to other organs and faculties still similar to and possessed in common with the first and most fundamental sort in brutes—that a man was not up to a certain point a mere monkey, and then made to receive the forms and faculties that again distinguished him from a monkey,—that entities beginning as brutes, could not ultimately by any superadded qualities end as human beings. No, for in such a case there would be no impediment why any entity, beginning as a brute, should not end as a human being.—A brute might then perhaps by superior care be nursed and cultivated into a human being, as a common working bee is by superior food converted into a queen bee, a thing which has never yet been witnessed.

From his very first beginning a human being

must already have been composed of the combination of elements, so much more varied and fine than those of which was first composed even the highest of brutes, as already to prepare room and latitude in the later superstructure for those higher organs and faculties of abstraction, which no brute is ever capable of forming and receiving; and in man all the formations and developments, from the very first mere insentient vital ones in which his individual existence commences, must already be different from, more complex than and superior to the corresponding developments of any brute, in order to admit of this superior capacity.

It seems that in human beings out of the first and most fundamental substances and forms already superior to those of any brute, was composed a blood in its elements so much richer than that of any brute, that when by the centrifugal pressure of the frame this blood driven out, and made on the muscle of the external and internal surface—on the body and the alimentary canal—with fresh elements from without to combine into nervous fluid, in its turn first consolidated into the roots of the organs of different senses, it already combined into organs experiencing a power of suction inward so much greater than the nervous fluid and first solids of the organs of sense of any brute, even the highest, experienced, that not only of the inner and sen-

tient extremities of these organs fewer tarried in the inferior and earlier parts of the body—in the inferior and lesser ganglia that are found along the spine, short of the brain—that already of these inner extremities of the sensitive organs a greater number were attracted to, and collected and concentrated in that brain—so that these ganglia in the body lost in size and in number of papillæ and powers of present sensation from without, what the brain gained in these respects,—but that moreover in the brain itself, from the greater exuberance of and impulse given to the nervous fluid, sprung forth between its papillæ ducts or nerves anastomosing, and conducting this nervous fluid from one papilla to another, not only so much more numerous, more elongated, and more variously distributed as to become capable, when matured, of leading the cerebral fluid to form sensations and ideas—recollections, images and others—of various individuals of the same and of different sorts, still concrete, more extensive and varied, than could arise in any brute, but, moreover, so much more ductile as when the cerebral fluid, in the formation and repetition of these concrete ideas, naturally passed oftener through the ducts leading to the papillæ representing the attributes on which the different individuals represented still resembled each other, and which still left them of the same genus, than through those leading to the papillæ representing

the attributes in which these different individuals again differed from each other, and which again rendered them different and distinct individuals, to make this fluid extend and fortify the former ducts, leading to the representation of these former attributes, much more, and give them much greater amplitude than the latter ducts leading to the representations of the latter attributes. Thus by degrees the cerebral fluid, after forming concrete ideas, in forming which the same papillæ, each time they were called upon to represent in the ideas of different entities similar attributes, were to be excited and struck afresh, of the portions of each attribute in which all the different individuals, simultaneous and successive of each sort still resembled each other, and belonged to the same species, at one single time would form one single picture or idea, from this process of abstracting its materials from divers prior concrete ideas, called an abstraction, or abstract idea or picture.

This for instance we do when, having first received from without, or conceived from within the mind, of different individuals of the human species, simultaneous or successive, ideas, each distinct from the rest in the portions they individually possess of time and space, and size and beauty, and other attributes, but each still, in the portions of these attributes, resembling each other, we leave out of the concrete representa-

tions of these entities, formed in our mind, the representation of the attributes which in each individual is dissimilar to the others, and renders it a distinct and different individual, and only keep and summon up in that mind the representation of the attributes through which each individual still resembles the rest, and through which each individual still belongs to the same genus with the rest; and cause these latter attributes, however distinct and separate they are in the originals, to be represented in the mind by the same papillæ, and thus of the human genus, of however many individuals, simultaneous and successive, different from each other, that genus be composed, and however many separate concrete ideas of these should be formed, if we wished to represent each separately at full length, cause the whole to be represented in a single abstract mental picture.

It is natural that the same cerebral ducts which lead the cerebral fluid from the formation of concrete ideas to that of abstract ideas, can also again lead that fluid back from the formation of abstract ideas to that of concrete ideas. That, having of the concrete ideas of different individual men formed the abstract idea of man, void of those differences, we should again be able to combine with this abstract idea of man, the concrete ideas of those dissimilarities, later seen or imagined in different human individuals.

And of these faculties of forming in the mind abstract pictures, like all other mental faculties, founded on peculiar organs, and on peculiar organs arising in man alone, the collective mass is called that of faculties of reason.

Even in different men there may arise organs and faculties of abstraction and of reason which, to their more fundamental organs vital, sensitive and intellectual, owe a development less or more extended; there may arise brains better or worse organized.

Nay, even brains originally of the same quality, as they are afterwards less or more exercised—as in being made to form concrete ideas less or more extended and varied, the cerebral fluid is made less or more frequently to pass through the same ducts, and to widen and strengthen those ducts through which it passes in its way to the papillæ, representing the same attributes in different external individuals, in a less or a greater degree, will be able out of concrete ideas to form abstract ideas, less or more extensive and varied, and again from these abstract ideas to lead back to other concrete ideas, less or more extensive and varied, with less or greater ease and readiness.

While one person may only, of a few superficial attributes belonging to a few men, and of a few individual men only forming a common species, such as that of either blacks or whites,

conceive an abstract idea, another person may, of attributes more deep laid and more fundamental, but of which the portions, like those which all created entities necessarily occupy of time and space, must link together man, brutes, vegetables, minerals, and in fine all that we can know and conceive in one genus, in his mind form a single abstract idea.

But to the last, abstract ideas may be founded on prior concrete ideas that are true or conformable to external objects, or untrue and discordant with external realities. Abstract ideas may thus, like concrete ideas themselves, be right or be wrong; reason itself may be just or may err; and we do not speak grammatically when we call ideas founded upon processes of reasoning, often very varied, very complex, but ill conducted, irrational; we should admit their still being rational or effects of reason, but only, as effects of reason ill conducted, condemn and call them errors of reason.

CHAPTER XXIX.

From the greater acuteness of their sensations, the instinct of brutes often already in peculiar effects assumes the appearance of reason.

MANY species of entities, still only able to receive and to produce mere concrete ideas, still only possessed of instinct, still unendowed with reason, still only entitled to the appellation of brutes, still in reality destitute of the distinctive characteristics of human beings, are already, nevertheless, through dint of their mere present perceptions of external modifications, so much stronger than those which human beings receive, by a shorter cut and by modes less circuitous, made to show external faculties, and to perform external voluntary actions, so much more directly and surely conducive to the purposes intended, than those which man, for similar purposes, through the circuitous medium of his powers of abstraction and reason frames and executes, that they are already erroneously called effects and works of art, a term only rightly bestowed on productions of the faculty of reason; though in reality they still are only productions of mere nature, before it has in animals caused and de-

veloped the organs and faculties of abstraction, necessary to produce the works legitimately called works of art.

We admire in the ant his thrift, in the bee his clever contrivances, in the spider his curious web, in the fox his cunning, in the dove his connubial affection, in the pelican her maternal love, in the dog his fidelity to his master; we blame the peacock for his pride, the magpie for his pilfering propensities, the tiger for his cruelty, the monkey for his tricks; we even feel gratitude to certain animals for the services they render us; we love them for their social disposition; we wonder that certain of them should immediately on emerging from the egg shell already perform for their benefit with certainty and precision, certain actions and works which man, after years of apprenticeship, with all his superior faculties, does not so well perform; and we thus in many instances give these brutes credit for mental capacities which human beings do not possess.

If in reality these animals performed the actions, executed the works, showed the propensities which we admire in them, in consequence of the intellectual stimulus to which we attribute these phenomena—to the effect of reflection, of foresight, and of reason,—not only they would possess powers of abstraction, but would even possess these powers in a higher degree than man himself. They often do off

hand, and as by inspiration, at an early age, and in the most perfect manner, what man, after much observation and experience, only often, by slow degrees, imperfectly learns to perform.

Their superiority, beginning earlier, would in age be maintained. Unless there were ostensible and adequate reasons for retarding the progress of later generations, or for making these retrograde, they would to the last maintain that superiority over man they had so early evinced. Every later generation, taught by the preceding ones, and adding its own experience to the lessons of its predecessors, would add new skill to the skill of former generations, and excel them more; above all, those brutes that show themselves very superior to man in one respect, would also show themselves much to excel him in every other faculty connected with that first. Their superiority, arising from the same stimulus as his, would in all things connected with each other evince a certain relative proportion.

The brute most early excelling in certain processes, certain works, would not to the present day remain the least skilful in certain others related to these first: the bee of the present day would not in point of capacity remain exactly at the point to which rose the first bee of the creation; the beaver in old age would not be condemned to show in his architecture no superiority over the beaver just brought forth, except

what a little more maturity and strength in his corporeal organs might be expected to give him.

Above all, where the skill and knowledge of man had been employed in cultivating the capacities of brutes, these brutes would, for their superior acquirements, be more esteemed by their fellow brutes that had been left in their state of natural rudeness.

But the reverse of all this is the real case. The brutes most remarkable for the early acuteness of certain of their organs of sense, for their early proficiency in certain peculiar works—and which generally are precisely among the inferior sort of animals—are those most woefully deficient in other respects. Those that on issuing from the egg shell most immediately show themselves most perfect in certain operations in which man only succeeds after years of trial, never even in these proficiencies make any further progress; nor do they show the least capacity for others, for which, had their skill proceeded from a mental stimulus, they must have shown a proportionate disposition. Among them no later generations improve upon the natural capacities or the works of earlier generations. Nay, if a beast has been admitted to companionship with man; if by man he has, for man's own purposes, been taught processes in which the rest of his species has been left deficient; and wishes with his new acquirements to revisit his native forest, far from becoming by the display of these new talents more accept-

able to his fellow brutes, he is by these ignorants shunned, regarded as contaminated, fled from or repelled. A beast or bird taught by man, who strays into his native wilds, is driven away by the whole herd of his former companions. He is only by these former comrades considered as having lost his natural instinct, in proportion as he has acquired the arts of man. He is thenceforth condemned to remain in the region of unmodified nature an exile and a wanderer.

The truth seems to be that in brutes, no doubt in consequence of their papillæ of sensation and thought having their vigour and strength less drawn off and wasted in later nerves or ducts of communication formed between them, than are the corresponding organs in man, have these papillæ, whether they be of touch, taste, smell, hearing or sight, susceptible of present sensations of external modifications, more acute than are the papillæ of sensation of man; that, from gravitation, electricity, cold, heat, elements of savour, odour, sound and sight, generically beneficial to these organs, and capable of giving them agreeable sensations, they derive directly much earlier, and from a much greater distance, sensations agreeable, and calculated to make them seek a continuation or a resumption of these sensations; and that from these same attributes, as soon as becoming generically injurious to these organs, and capable of giving them sensations irksome and disagreeable, they

also derive directly much earlier and from a much greater distance, sensations disagreeable, and calculated to make them flee from and seek a discontinuance of these sensations; that they need, in order to obtain the former sort of sensations, and to shrink from the latter sort, the circuitous stimulus of thought, and of the bad effects these sensations may eventually produce, much less than man; and that these organs of present sensation inward so much more acute, and so much less having their quickness wasted in developing in later ducts of intellect than those of man, are again immediately developed in organs of reaction outward, by the peculiar impulse given them, much more nicely calculated to develop in the forms necessary to obtain the fewer elements that are generically beneficial to them, and to flee from or repel those other elements that are generically noxious to them than those of man. That through the bounty only of nature directly, and without any contrivance invented by their own ingenuity or reason, as long as they receive from without elements beneficial and sensations grateful, they are by their very mechanism made to seek the continuation or resumption of these sensations, and that, as soon as they receive from without elements injurious and sensations irksome and unpleasant, they are by that same mechanism made to avoid their continuance or resumption, more immediately and forcibly than man.

That in reality brutes each of certain external

modifications, receive sensations much more acute than man, cannot be doubted, when we see the effect of electricity on certain fish and fowl; when we see the dog, through the mere smell, trace athwart the grass the track of the hare, which remains unperceived by man; when we see in air a hawk watching a mouse peeping from a hole in the earth which man cannot, though much nearer, discern; when we see brutes watchful of sounds and sights which man passes unnoticed.

At the same time, while in brutes the sensation of the peculiar elements of which their organs of sense are composed, is so much more powerful than it is in man, they each have organs of sense only composed of elements so much fewer and less varied than those of man, that the dog who smells the scent of game most unerringly, will not be diverted from his scent by, nor indeed smell the odour of the strongest herbs, among which he hunts out his prey.

Thus it appears, that of mere electricity the modifications, the changes and the stimulus are already by the most inferior brutes so strongly felt, as alone to suffice to impel certain molusca and insects, certain fishes and birds, to peculiar movements and migrations with such unanimity and precision, and in an order of march so well calculated to overcome the pressure they have to encounter, that they will all be seen to sally forth and to set out the same day and hour, and to cleave the wide expanse of the ocean or the

air, without knowing what they fly from, what they seek, and whither they are bound, in the order and direction best calculated to lead them with certainty and precision to the regions, however distant, where they are by nature destined to halt; that the quail, prevented from following his comrades, will, in his impotent efforts to liberate himself from his confinement, break his head against the bars of his cage; and that thus by brutes long voyages are performed through the mere ordinary impulse of a fluid, of whose pressure man, unless it is more than usually condensed, or unless in a morbid state his organs of feel become more than usually sensible to its impressions, remains unconscious.

Thus it is that through the impressions of taste alone, brutes are made to feed on whatever is salutary to them, and to abstain from touching whatever may injure their constitution; nay, are only made to consume the particular food, congenial to their frame, as long as it contributes to their welfare, and to leave off feeding the moment they have had sufficient nutriment; that those animals, first only formed of vegetable matter, and consequently only wanting vegetable matter for their further support, are only allured by the flavour of vegetables, and are, by the effluvia of animal matter, injurious to their organs, nauseated and repelled; that even from a great distance, and without yet knowing that he is threatened by any real danger, without yet even seeing his

natural enemy, the ox or the horse flies from the forest where lurks the lion or the tiger; and, when the latter pursues and presses strongly upon him, the one with his horns, and the other with his hoofs, attempts their repulsion and his defence.

Thus it is that the oyster, as long as the water on which he feeds is beneficial, and consequently is grateful to him, is made to swell and protrude his muscle, and thereby to take in more thereof; but the moment he is sated, by the mere repletion that substance causes in his organs of sense, is made to loathe any further influx, and to close to it his shell.

Only the higher brutes, which have more powers of intellect, will sometimes by the allurements of the sense be betrayed into actions eventually noxious: the ox indulge in the rich pasture till he bursts; the elephant eat sugar-plums till he turns sick at the stomach.

It is not by any nice discrimination of the respective attributes of any fellow worms, still less by the consideration of the effects, physical or moral, of any misalliance with them, that the mollusca, the worm, avoids any mixture of races; that he is prevented, in the darkness of his subaqueous or subterraneous abode, from committing a rape on a mollusca or worm of a different sort. It is that the effluvia of a worm of the same sort alone can attract him; that the effluvia, of a different sort even of worms, repel and nauseate him.

Nay, even when a brute is attracted by the

effluvia of other brutes of the same species, so little do in their origin the effervescences, the ebullitions of the spirits that lead to aggressions of love or of war, differ from each other, that he knows not yet whether he approaches a female or a male of his species, and whether he is going to give proofs of concupiscence or of aversion; that it must only depend on the reception he meets with, whether he shall vent his ardour in caresses or in combats; that the first risings and symptoms of lust and of anger differ but little. Of the male the first approaches always seem hostile; he begins with pursuit, and the female responds with flight or repulse. If the feelings of the sex at last subdue her, she submits; but even in spiders the act of union only takes place after mutual advances and retreats, resembling those of animals entertaining fears at least equal to their desires, and doubtful whether they approach to caress or to be devoured. In the feline tribe love scenes to the last are accompanied by violence—by biting and scratching; and in the human beings of the lower tribes and classes, the demonstrations of lust still differ little from the symptoms of anger.

If the animal is, by the effervescence of his spirits, made to approach another of his species, who like himself is a male, who leaves him not room to vent his ebullitions in acts of love; who feels an effervescence of the same sort with his

own in an opposite direction, who receives his advances with corresponding repulses, the excitement which began in attraction, for want of vent, ends in irritation and in combat; and thus it is that of each brute species the males, especially in the season of love, are constantly at war. The gentlest stallion will in that season, when he finds not the means of venting his ardour, become so excited as to bite or kick his own master.

Again, if every brute, for defence or for attack, uses exactly the organs best adapted for the purpose required; if the oyster, when pressed, closes his shell; if the seppia, when pursued, voids his inky liquor, and escapes under an impenetrable cloud; if the crab and the beetle, when touched, lock their pincers; if the wasp protrudes his sting; if the horse shows his hoofs and the ox his horns; if the tiger uncases his fangs and claws; these movements do not proceed from the animals having nicely calculated their means of attack and of defence; they only proceed from those peculiar organs, which the rush and efflux from within has begun to render most strong and most active, naturally continuing to be those which, on any sudden excitement or emergency, this rush of the spirits to them disposes first and most preferably to any act of attack or defence.

Already in his infancy every animal is, by that same rush to the parts which it renders strongest and most active, impelled in his very sports and

gambols to use by preference the same organs, to which he afterwards most trusts for success in his more serious engagements. The colt already kicks in play with his hoofs, the kid already buts with his still hornless forehead, the kitten tries to catch the toy with his still innoxious paws, the puppy already gnaws with his still toothless gums.

Let us view how in some most inferior brutes mere present impressions from without on the sense—mere instinct—impel them spontaneously with the greatest precision to acts, already in their effect similar to certain of those which in man are only the circuitous result of the nicest calculations of the mind.

When the bee, dignified by the name of queen —that is to say, one whom the organs of generation, fully developed, enable to perform the sexual functions—has laid eggs, of which some, by the full assemblage of all their component elements, develope into perfect females or queens similar to the mother, and of which others, from the deficiency of certain of these elements, only develope into females less complete, less able to attain the full development of their sexual organs, and destined only for toil, the first of the young queens that emerges from her cradle, already is by the excitement which the effluvia of the other queens, still torpid in their cells, cause in her, induced to seek, to go round to, and to destroy in the bud those others, which, if suffered to live

and to grow, might become her rivals; while, on the contrary, by the relief she experiences in venting her own effluvia on the workers who want these emanations, there arises between her and those workers that relationship which, through life, produces in the former her influence, her sway over her subjects, and in the latter their obsequiousness to their queen, their neutrality between two queens that fight for supremacy, and, when they have entirely lost the queen from whom they imbibed the effluvia grateful to them, and on whom they in their turn, as readily for the sake of riddance, of the food they had collected, bestowed the richer portion, by themselves nauseated, now vent it on some young worker, who, thus sumptuously fed, herself grows into a queen. In the morning, the mere scent from a great distance attracts the bee to the flowers. At eve, and even earlier in the daytime, on the approach of a storm, the mere disappearance of the sun's rays, and the consequent chill, sends the bee back to the hive. The mere weight of the honey and wax she has gathered makes her, on her return, hasten to clear herself of the incumbrance; and where so many bodies, so close pressed, with one accord push away from them two such different substances as wax and honey, the more cohering naturally takes the octagon form we so much admire, and the more liquid flows in the intervening interstices. In the cells

that remain empty, the queen, when oppressed by her eggs, finds for these ova the most ready receptacle. That in the acts of the bee, which at first sight seem to us the effects of so much forethought, there is no intellectual stimulus, may be easily proved. Deprive a bee of her antennæ, the instruments through which she receives the effluvia by which she is ruled, and the spell of her curious demonstrations is broken at once. From an animal replete with activity, with ingenuity, with contrivance, she becomes a stupid, helpless, torpid brute; she has lost all her nice feelings of order, of subordination, of loyalty and of thrift; she becomes henceforth in the populous and busy hive, an isolated, dull and forlorn wanderer, without interest or occupation.

The ant likewise is only by present sensations stimulated to his various actions and fabrics. That he has in performing these no intellectual motive, no forecast, is proved by his still continuing to perform them when they no longer can answer any beneficial purposes.

Even the spider is only by her solicitude to get rid of the viscous matter which loads her stomach made to extract and to spin it in the form of that fine thread, of which the web serves to her securing more food, and of which the form obliges her to hold in that web the situation best

calculated to watch the inroads of her future prey. When the struggles of the victim have damaged the net, its substance produces the fresh effluxes by which that net is repaired.

The bird species, so organized that the sort by pre-eminence called the Weaver, is made by its sensations, even when single, and in a cage, to weave round its bars the tissue of a nest, without yet destining that nest for any peculiar purpose, when impregnated is made, from the weight of the egg in its womb, to derive a restlessness, which seeks vent in forming the receptacle best suited to her forms and organs. In this nest her increasing uneasiness makes her seek repose, deposit her dropping burthen, and, without knowing whether it be an egg or a stone, sit on the same, to relieve her breast of its oppressive heat. When one side is warm and solaces her no longer, she by mere instinct turns to her body its other and cooler side. Thus she hatches her young, and to get rid of the food that oppresses her stomach, pours it into their ready maws, till each being reciprocally strengthened, and no longer wanting the other, goes its own way, without there remaining on the mother's side a trace of that affection which seemed to have inspired cares so varied, so protracted and so patient.

If the tigress defends her whelps which the tiger seeks to devour, she only defends that

which during the weakness which follows parturition, disburthens her of her troublesome milk, and gives her a welcome warmth.

If the dog, inconstant to his canine mistress, is faithful to his master, defends during his master's life his person and property against aggression, and after his death often follows him to the grave, it is that of that master the effluvia are become necessary to his existence. In defending his master he only defends what he considers his own property, his own means of enjoyment and of comfort. If weaned from these he sallies forth, sniffs up the air, and, as soon as he finds another person whose effluvia agree with his constitution, seeks no further; his election is made,—he follows that person home as pertinaciously as he had done his first protector.

If the monkey mimicks man, it is neither from admiration of his superior merit, nor from ridicule of his manners. The eye is in the monkey the ruling organ; the impressions of sight those that exert over him the greatest power. Man's habits and movements, through the organs of sight of the monkey, produce in that brute's brain an excitement, which he can only vent by performing similar movements. On seeing the reflection of his own person in a mirror, he experiences a similar agitation, turns the object which interposes between himself and his image round and round, and seeing that image escape him,

in his fury dashes the glass to the ground, and puts an end to the delusion.

If in the season of sexual desire the males of certain brute species utter cries which the females of the same species answer, it is not that they understand each other, it is only that the cries uttered by the former, in consequence of their feelings, excite in the latter, through the sense of hearing, similar feelings.

If certain animals are gregarious; if they seem to obey a leader, this is not from their having any mental conviction of the advantages of society; it is only because they enjoy each other's atmosphere, and are most influenced by that of the strongest and most vigorous individual of the herd.

If in the South American pampas the blood of a slaughtered ox collects around it all the oxen of the neighbourhood, and causes them to roar and to bellow, it is not that they deplore the loss of their comrade, and excite each other to revenge his death; it is only that the sight of a red object raises in these quadrupeds the same fury it gives rise to in turkies, and other birds.

If an owl, who ventures forth in the daytime, gathers round him all the other birds of the forest: if in the same way a human being collects round him all the monkies of the wood: if in these brutes arise a hooting and hissing, which increases till it grows into insults and out-

rages still more tangible, this is not the effect of moral causes or considerations: it proceeds only from the physical excitement produced by a sight so unwonted.

If the magpie steals the silver spoon, this is only in consequence of the general fondness of birds for substances calculated to form a nest. The magpie collects the worthless stick with equal care, and often drops the piece of plate with equal indifference.

The lion's bravery is a fiction. Hunger only is his stimulus, and fear of his foe soon makes him turn tail. The horse appears more daring, but this only proceeds from his greater ignorance of danger. While he rushes heedless among the enemy, he trembles at his own shadow.

Entities yet only possessed of mental organs, capable at best of forming mere concrete ideas of external individuals, entities and modifications, in their character as individuals distinct from other individuals of the same species, as well as from other different species, not in their character as parts of species more extensive and durable; entities unable yet to conceive ideas of attributes as belonging to whole genera; entities incapable of forming abstractions and generalisations—entities, in short, only distinguished by the appellation of brutes, and not yet entitled to the name of human beings,—can attain none of that knowledge of attributes and modifications which they

perceive, as pertaining to, as forming essential parts of every individual belonging to a genus, which knowledge we particularly and pointedly call science; nor can they form any ideas of transferring any of these attributes and modifications from the species which by nature possessed them, to other species who do not—of combining together productions and modifications of nature, before separate and distinct,—which we call processes of art, of whatever sort they be; and whether only called mimicry, which purely consists in making the limbs, features and other faculties, supplied by nature, perform movements and actions not prompted by mere nature, but suggested only by the sight of the movements exhibited by other entities; or whether by the desire of more permanent attributes of certain external entities being applied to other entities who possessed them not before, they be more pointedly distinguished by the name of imitation; whether called of invention, representation, classification or method; whether for purposes of utility only, or for purposes of direct gratification; and whether finally for purposes of gratification to the lower senses, called pleasure, only, or for purposes of gratification to the higher senses of hearing and sight, and to the mind, called beauty.

If the parrot seems to mimic sounds, and to use an artificial and conventional language, it is only

that those sounds striking his ear, produce in his sense of hearing an impression so agreeable as to make the ebullition, thence transmitted to the organs of reaction outward, situated in his throat, in these organs produce movements, in their turn producing similar sounds, without his attaching to them any peculiar meaning, or producing them with any peculiar intention of mimicry.

If the monkey seems to mimic movements and actions, to walk and to behave like man, it is only that the peculiar carriage and behaviour of man, striking his eye, produce in his sense of sight an impression so forcible as to make the effervescence, thence transmitted to his organs of reaction outward, situated in the limbs and features, in these produce movements in their turn producing a semblance of similar actions, but also without his attaching to these actions any particular meaning, or even performing them in consequence of any design to mimic.

No entity yet incapable to form any abstract idea—no brute—can yet be capable of feeling those sentiments, those dispositions, those desires and those aversions, those impulses toward and those shrinkings from certain external entities and modifications, which only arising from the same cause from which arise abstract ideas, are called mental propensities, and when very forcible, are termed passions. They can neither feel love, friendship, benevolence, affection connubial, pa-

rental, or social, gratitude or esteem, if by these words we understand affections which only proceed from abstract views of certain qualities in certain entities; but as they are not capable of harbouring feelings friendly to others, they are not either capable of harbouring feelings unfriendly to them; as they cannot feel mental sympathy, they cannot feel mental antipathy. They are not liable to anger, to fear, to jealousy, if by these words we mean, no longer the aversion merely arising from a bodily sensation, or a mental recollection of a disagreeable sensation, positively already at a particular time and in a particular place produced or imagined in the sense, but that aversion arising from the idea of such a sensation produceable in indefinite and abstract portions of the idea of time and place. Susceptible of irritation in consequence of an injury done or imagined, they are not susceptible of anger in the abstract; susceptible of dislike, of reluctance to face, of aversion to and shrinking from some external object that produces a disagreeable sensation on the sense of smell, or hearing, or sight, or of having a painful recollection of such, they are not susceptible of fear in the abstract, felt without being attached to definite periods of time and place, and to definite entities and modifications; above all, they cannot yet experience in consequence of abstract ideas any feelings of sorrow, envy, hatred, malice, am-

bition, avarice and other passions, injurious to themselves or others. As they cannot feel an abstract wish to please, they cannot feel an abstract desire of injuring any other individual. As the gentlest dove has no sympathy with another dove in distress, the tiger, most arraigned for cruelty, tears his prey in pieces, without any idea of injuring a fellow creature, without any view but that of promoting his own bodily gratification.

CHAPTER XXX.

Of ideas simply called concrete, the only sort conceivable by brutes, and the first sort conceivable by human beings, the merits and demerits, the advantages and disadvantages, compared with those of ideas called abstract.

Of external objects and modifications in time and in place distinct from other objects and modifications of the same sort, or of other different sorts:—of external objects and modifications, as individuals different from other individuals simultaneous with or successive to them,—the concrete ideas, which represent each in their dissimilarities to, as well as similarities with the others, and which consequently may represent each in its full length and in all its attributes, may give in the mind an idea more complete, more accurate, more definite, more in all its details like the original represented, more fully and truly representing that original, than the abstract idea, which leaves out of the representation of that original that of its dissimilarities to other individuals of the same sort, and only gives that of certain of its similarities to these, condensed

in a single picture, and produced in a single set of papillæ of sensation and of thought.

The abstract idea, of a number of individual entities and modifications of the same sort, different in time, place or other circumstances, from each other, which leaves out that of these differences, and only retains that of the similarities concealed under these differences, cannot convey that of other dissimilarities yet unseen, arising from those beheld, which nevertheless must in reality arise from these, and must be taken into consideration, in our estimate of their advantages and disadvantages, of their tendencies good or bad, of the eligibility of seeking or of avoiding them; and must consequently influence our actions and our conduct. We are, in acting in consequence of abstractions and generalisations, on less sure grounds, than in acting in consequence of concrete ideas of individuals.

But as concrete ideas represent external objects and modifications more at full length, not only in their similarities but in their dissimilarities; as of each individual entity which they do represent, they represent the similarities as well as the dissimilarities by different papillæ, or at least by the same papillæ at a different period of time, their representation must in the brain occupy so much more space and time, and employ so many more different papillæ than that of abstract attributes and modifications, that the most

capacious brain of the most long lived man can contain, can find in time and space room for concrete ideas of far fewer individual objects and modifications, in which are represented their dissimilarities as well as similarities, than it can contain, can find time and space for abstract ideas, in which of these objects and modifications the dissimilarities are entirely left out, and the similarities only lumped together, and represented by the same papillæ.

We shall only of a small number of men carry away an idea fraught with all the diversities that distinguish the fate of each singly from that of the others; but we shall of the genus called man, easily embrace a general idea in certain of the attributes which belong to and confound together all the individuals of the genus.

The mind of any single individual therefore, however capacious, can only afford room for a limited number of concrete ideas, and when it wants more such ideas, on which again to construct others, and to found consequent resolves and actions, must out of these concrete ideas draw abstract ideas, calculated to render their calculations more concise, more condensed, but more indefinite and less certain.

Abstract ideas are thus in entities, whose situation requires and renders necessary resolves and actions outward very numerous and varied, to the prior concrete ideas, a necessary and an

advantageous supplement. They aid us in forming gross calculations without the incumbrance of details.

At the same time they are only of external objects representations abridged, indefinite, and as it were produced by a short-hand method often very inaccurate, and giving but an imperfect, a vague, and frequently a very erroneous notion of the originals they represent. If they facilitate more extensive calculations, we can less depend upon the justness of these calculations: upon their applying to every possible case.

But we can in much less time and space form calculations much more extensive, more varied, more comprehensive, more applicable to time, space and other objects in general. We can by their means in one single mental picture comprehend and condense the miniature representations of more external individuals and genera. A single abstraction may offer the picture of certain attributes that belong alike to the first and last, to the lowest and highest modifications that we know or can conceive in time and space. They may even, by not only proceeding from concrete ideas, but again by a circuit leading to such, facilitate the concrete ideas, the recollections of existing objects.

Nor is this all. If of the different individuals on this globe out of its various elements com-

bined, the elements, on their again decombining, go to higher and more extensive globes, as we have reason to suppose, and there again are recombined in entities more extensive and more perfect, each singly and individually composed of the elements formerly belonging to many distinct individuals and species simultaneous and successive of prior lesser and more imperfect worlds, the concrete perceptions and sensations that must arise in these higher and more perfect individuals, must themselves already only be similar to the abstract ideas of entire genera, such as we conceive here below, as extracted from the concrete ideas of different individuals dispersed over this globe. What at present are only abstractions and generalisations, unlike actual realities, and only founded on vague and indefinite ideas of such, may then only be on retrospection considered as anticipations of those ideas which in a higher globe hereafter we shall receive in the more clear and definite shape of actual sensations from without, and of the concrete ideas by these produced.

Even on this imperfect globe, by the mental organs capable of forming abstract ideas may be conceived many ideas, wills, resolves and reactions outward, which cannot be formed where only arise the organs capable of forming mere concrete ideas.

First may out of them arise a knowledge, not

yet arising from the mere concrete ideas of peculiar portions of attributes, as only belonging to peculiar individuals in their capacity as such, but only arising from the abstractions of such ideas of these portions of peculiar attributes of these individuals, in their capacity of portions of more extensive genera, which knowledge is dignified and distinguished by a translation of its name in Latin,—by the name of science; as for instance, when out of the knowledge of the movements of peculiar individual heavenly bodies, we form the abstract idea of the science of astronomy.

Next may out of them arise an abstract idea of applying that abstract knowledge of certain peculiar attributes or modifications of nature to peculiar practical purposes, not yet accomplished by mere productions of nature themselves; of decombining them from the objects to which they belong, and combining them with other objects from which they were separate,—which process we call a process of art; as for instance, when we form the idea of combining with the natural forms of the human limbs, certain metrical movements, which are not suggested by mere nature, and thus invent the art of dancing; or when we form the idea of separating from a plant its filaments, and uniting these in a peculiar tissue, which we call the art of weaving.

Of these ideas of art may arise different sorts.

There may arise ideas of producing from certain external objects and modifications the decombination of certain of the attributes by nature attached to them, and the recombination of these attributes with other objects and modifications, to which they were not by nature attached, and thus, of producing, by means of this decombination and recombination, new forms and faculties not before by nature produced, which are called inventions.

There may arise ideas of producing, through certain attributes, already by nature offering a certain resemblance to other attributes again different from themselves, a still greater intentional resemblance to these others, which when only produced by giving to natural limbs and faculties an evanescent resemblance only to the movements and sounds of peculiar other entities is only called mimicry, and which, when it rises to the idea of producing through certain substances, decombined from those with which they were united, and recombined with others from which they were separate, a resemblance more permanent to the forms of other peculiar entities—as we do when through ductile clay we produce a resemblance to their tangible modifications, and when through spreading colours we produce a resemblance to their visible forms—we call imitation.

There may arise ideas of conventional repre-

sentative signs, such as those signs for things and ideas, called words and language, addressed to the ear or the eye, spoken only or written.

There may arise ideas of classification and of method.

It must, however, be understood that between the first origin and formation of the mental organs, through means of which these mental productions or ideas may be afterwards effected, and between the later maturation of these organs, which may first actually enable the ideas to be formed, a great lapse of time, and a long process of successive developments must intervene; and that even when these ideas are formed in the mind, they can only be executed by the body, through dint of instruments called organs of action, which again, from the organs of mind flowing outward, mature at the same time with those of mind themselves.

It must, moreover, be understood, that not only those organs and faculties of mind, by which these combinations of art are conceived, and those organs and faculties of body, by which they are executed, but those very materials out of which they are formed, are still only further developments of nature herself.

The most complex court petticoat, with which a fine lady disguises her natural forms—composed of brocade, of lace, of whalebone, of hair, of wool, of fur, of cotton, of diamonds, of tinsel, of dif-

ferent dies and pigments, &c. must still be composed of materials all drawn from the mineral, vegetable or animal reigns of nature.

This is not all: while brutes, while entities, able only to form concrete ideas, unable to form abstract thoughts, cannot entertain any of those mental feelings, either beneficial in their tendency, such as those of affection, connubial, parental or social,—of friendship, of benevolence, of wish to oblige,—or injurious in their tendency, and called passions, entities able to form abstract ideas, may be made to entertain all these feelings, and from some of them to derive pleasures, and from others pains, mental and bodily, unknown to brutes.

It however must appear that though only in peculiar organs not produced in brutes, can, when matured, arise the faculty of producing abstract ideas, and all the other consequences of these, here set forth, and though of these organs a certain quantum is necessary to entitle its possessor to the name of rational being,—of man,—even in men, formed of materials less or more rich and copious, these organs and faculties will only develope in different degrees.

That as in certain brutes so in certain human beings will first be laid the foundation of organs of sense more fine and more acute than in others; that next in some will, between these organs of sensation and thought, be formed ducts of com-

munication more numerous and more varied than in others; that again, in some these ducts will, by more use, exercise and cultivation, be rendered more capacious, more active and more flexible than in others; and finally, that in some the cerebral fluid, more attracted to the ducts serving to form abstractions than in others, will even, as they form abstractions more extensive, again lose their readiness to form and to retain concrete ideas of distinct individuals.

CHAPTER XXXI.

Every time and place was not equally suited to every sort of combination inorganic and organic, vegetable and animal.

Of the different species of entities especially organic, vegetable only, or also sentient, which were made to arise on this globe, the first individuals were not each able to arise in the same place, or even at the same time with those of each of the other different species.

Whether it be that there already in the atmosphere, and at the surface of this globe, existed elements of sorts and in quantities sufficient for combination in certain species of organic entities, before this atmosphere and this soil were supplied with elements of sorts and in quantities sufficient for the formation of other species, or whether, even supposing this atmosphere and this soil were at the same time and simultaneously supplied with the elements requisite for every species of combination, of some of these sorts the actual combination could not take place until of other sorts, simpler and less complex, the combination had first prepared their bases

and moulds, this is certain, that we not only in certain places find, of certain entities organic, vegetable and animal, the substances in such a state,—find for instance carbon or the chief material of vegetables, in such a liquid state of naphtha and petroleum, and in such a solid state of sea-coal, and find nitrogen or azote, the chief material of animals, in such a state of oily and fatty matter, divested of all remains of organization, as to warrant the belief that in those places it lies, not as a substance which has already been organized and has later again been decomposed, but as a substance which has originally been accumulated in masses so dense, so little accessible to any of the finer aerial elements, as never to have with them been combined in entities of an organic sort vegetable or animal; while in other places we find the relics of divers entities vegetable and animal actually combined, so disposed relative to each other in time and place, as to prove that some of them could only be combined and arise, where certain other simpler and inferior ones had been combined, and had arisen before.

Thus we find the relics of many productions of a vegetable description where no relics of any vegetables of a higher and more complex sort yet appear; as for instance, over mere inorganic masses relics of criptogamous plants, where no remains of phanerogamous plants are found;

of monocotyledinous vegetables relics, where no remains of dicotyledinous plants are perceptible, and of different sorts of vegetables relics where no remains of any living entities of an animated species are found.

Thus again we find remains of primeval animals of the lowest order, produced in water, of worms and mollusca, where no relics of animals more late and complex, produced in air, of insects and birds yet are found: of animals still invertebral, where no remains of animals vertebral yet are found: of animals vertebral of an inferior sort, such as fish and reptiles, where no remains of brutes of higher sorts are found.

We even find traces of a period when no animal higher than reptiles, or animals capable of subsisting partly in water, still existed; but when these latter, not having any part of their substances and materials yet drawn off from them and monopolised by other higher animals earthly and aerial, more complex and more elevated than themselves, attained a development, which has later again ceased; when all those large and monstrous amphibia, since regarded as fabulous, still in reality existed, when the confines of the water and the land teemed with gigantic saurians, with lizards of dimensions much exceeding those of the largest crocodiles of the present day, who, to the scaly bodies of fish, added the claws of beasts, and the neck and wings of birds; who, to

the faculty of swimming in water, added not only that of moving on earth but that of sailing in air, and who had all the characteristics of what we now call chimeras and dragons; and perhaps of such monsters the remains, found among the bones and skeletons of other animals more resembling those that still exist and propagate, in the grottos and caverns in which they sought shelter during the deluges that affected the infancy of the globe, gave first rise to the idea that these dens and caves were once retreats whence such monsters watched, and in which they devoured, other animals; and left after them the relics of the havock and devastations which they inflicted on the surrounding regions.

Of these dragons we again find the more deep buried remains, followed later in time and higher place by those of other animals herbivorous and frugivorous more enormous than, but more closely resembling those of the same class, that still subsist on the face of the earth; by those of mammoths, of mastodons, of elephants, of rhinoceroses, of rocs, and of other palæotheria of the beast and bird species, more huge, more generally dispersed over the globe than, but more similar to the elephants and rhinoceroses, and eagles and condors, that still live and propagate.

And of these animals, all still herbivorous and frugivorous, larger and more potent than any still existing, which have since been again all

destroyed, we find the last again succeeded by those animals of a carnivorous sort, still existing, but of which the most formidable species are every day more and more hemmed in, and deprived of room to expand and to propagate, by the extension and propagation of all devouring man.

It fares on the waters as on the land: there is no reason that to assert that the ocean was not once peopled with those polypuses, of which Pontoppidan describes the remains under the name of craken; that the Mediterranean was not filled with those cetacea of which the Bible mentions an individual as having swallowed Jonas. But of the one and the other no specimen now remains.

Finally, only last of all, and after many of the largest and hugest of the former species of animals had again considerably diminished, or indeed disappeared, are found the earliest relics of human beings, whom consequently we must suppose only to have risen on the ruins of certain of the former entities, and only to have spread through means of the decomposition and remixture of the elements of a greater number of these former ones.

Nay, if it be true that certain inferior vegetables and animals can only be formed out of, can only live upon the elements exsuded by different parts of prior more complex vegetables

and animals, which during their life, or after their death, again are partly or wholly decomposed, it must be evident that even some of the highest individuals in our estimation must have been previously formed as a base and stepping stone to some of the lowest; that only after some of the highest have been previously composed, some of the lowest and most despicable can subsequently have arisen.

It fares the same with space as with time. In certain places we find only elements of peculiar sorts in sufficient quantities for peculiar inferior combinations. In these places the elements whose addition is requisite for combinations into higher entities do not exist in sufficient quantities for that purpose, and consequently allow not these entities to be formed.

In regions to which the sun, the chief source of the elements that form and impress the senses of taste, smell and sight, only sends forth its rays more obliquely and more sparingly, and at greater intervals, bodies both inorganic and organic are in general individually less powerfully knit and combined, less vigorous and less extensive, more lank and inelastic, more insipid in taste, more weak in odour, more dusky in hue, than they are in regions where the sun pours out its elements in greater abundance. It is only as from the opposite poles we approach nearer to the intervening line, that we find en-

tities inorganic and organic, vegetable and animal, more capable of impressing strongly by their attributes the external sense.

Only between the tropics we find in the mineral world the richest crystals, marbles, porphyries, jaspers and gems—the diamond, the ruby and the zapphire. There only the vegetable world displays its ferns forty feet high, its grasses soaring to the height of trees, its cactuses like columns, its creepers whose tendrils form cables able to support in their fall the stoutest stems, palm trees from whose scaly stalk the feathering foliage only begins to spread a hundred feet above the base; the Honduras wood which cuts up in boards ten feet wide, the banian tree, whose limbs, reverting to the earth from which they rose, spread over whole acres of ground, the banana plant whose leaves singly form a garment or a roof, and other plants whose flowers exceed in size the largest shield.

There only in the animated world arise those corals whose scarlet branches form submarine forests—the chama gigas on whose muscle a whole ship's crew makes a plentiful meal, the pearl shell, the paper nautilus, the diamond beetle, centipedes like serpents, spiders like crabs, lizards like crocodiles, butterflies like birds, snakes able to swallow oxen, the parrot, the peacock, the bird of paradise, the ostrich, the elephant, the giraffe and the tiger.

If, however, in the same way that certain higher productions cannot arise in certain poorer regions, certain poorer productions cannot rise in certain richer regions,—if richer materials as well as poorer ones are inimical to certain combinations—if the rose and the cherry only are found in temperate climes—it is that, as in the combination of entities there enters more of one sort of element necessary to produce peculiar combinations, there must proportionably enter less of other sorts.

Nay, if in those regions in which the external splendour of the vegetable and brute races is carried to the utmost pitch, the faculties internal and external of man are not varied in the same proportion, this proceeds from the regions where certain elements emanating from the sun are each individually received in the greatest abundance, not being those regions where opposite elements are made to meet and to combine in the proportions best calculated to check, to control, to poise and to balance each other.

CHAPTER XXXII.

Gelatine, rete mucosum, external bone and internal skeleton.

I HAVE shown how of all animals were first formed the more vital insentient parts; how on the muscle of these were next by exsudations from within, with new elements from without, superstructed organs of sensation, of which the first external roots were formed directly under the epidermis, and there composing the dermis, became capable, when by elements similar to those of which they first were formed, afterwards matured, of receiving from without of similar external elements impressions, which they carried through nerves to their inner sensitive half, where these impressions produced in the papillæ of actual sensation, first sensations and next thoughts. How between these papillæ of sensation and of thought arose internal ducts of communication, through which the cerebral fluid recombined those thoughts in new ways, different from those in which the sensations first came from without. Passing over all the intermediate periods intervening between the first foundation of these organs of sensation and

thought in the fœtus, and their full maturity, I have represented them as actually able to produce the sensations and thoughts, desires and aversions—the wills—for which they had been gradually prepared, in order to bring the view of the first cause and of the ultimate effect nearer.

But I have not yet described what in reality intervenes in the intermediate period between the first foundation of organs of sensation and thought, and their ultimate maturation into the actual present possession of the faculty of feeling and thinking: namely, of the fluid that by going inward formed and matured these organs, a part again being made to recoil outward, and in that direction to form the nerves or ducts, leading to the muscles on which are seated the roots of the papillæ of sensation and thought; and through these nerves or ducts outward remodifying these muscles themselves; and when afterwards sensations and thoughts, desires and aversions, and wills are actually experienced, this cerebral fluid, through these nerves made to flow outward to the muscles, or to be withdrawn from these, causing in them orgasms and protrusions, or depressions and retractions, corresponding with the will.

Had these nerves outward not been formed: had sensations, thoughts, inclinations, and aversions in the mind been produced without the same cause producing voluntary impulses out-

ward, or voluntary retraction from without, no actions could have arisen corresponding with the will. If that will had led to any thing beyond it, that could only have been suffering and misery.

But by the peculiar mechanism of the animal frame, of the very influxes inward that produced the first rudiments of organs of sense, thought, inclination, aversion and will, long before these organs were matured to actual sensation and thought, the partial recoil outward, also, again produced the first rudiments of nerves outward into the muscle, through which the continuation of these effluxes would afterwards, when sensations, thoughts, and wills actually arose, be in the muscle produced orgasms or retractions, which would cause these wills in the mind to be followed by corresponding reactions outward in the body.

When in higher animals, at a later period, we see a skeleton included within their more external parts, and giving to these parts more decided forms and firmness, we are tempted at first to consider this solid skeleton as the earlier frame on which these parts more external and more pliant have afterwards been superstructed.

The contrary is the case: the softer and more pliant surrounding parts are the cradle, the mould, first formed, which in their turn first produce, and in which are first consolidated and moulded

the materials whose aggregate ends in a hard bone.

Among the elements from without with the lymph and the chyle introduced in the blood, there is one called gelatine; and after the blood has first exsuded its fibrine, and consolidated this fibrine round it into muscle, it again athwart the muscle itself exsudes this gelatine, which beyond it consolidates into what is called the rete mucosum. This rete mucosum in its turn, where it is more abundant, hardens into gristle, or bone still pliant and diaphanous; except where by the later influx of other elements of various sorts, taken in through the blood, it becomes more dense, more tough, and more opaque.

Animals formed and intended only to continue living in the narrow and tortuous interstices of the earth, where their forms are required to preserve to the last the utmost flexibility, inhale not from air sufficient elements calculated to harden their rete mucosum into any thing more than a mere pliant envelope or sheath: the tissue that lines the rings of the earth-worm, to the last continues yielding. It never hardens into firm plates or stays. These animals have no bones either inside or out.

Even of animals formed and intended to live in water, there are some, such as certain zoophytes, round which the rete mucosum exsuded from them remains a mere porous and yielding

sponge, but in most animals either aqueous, or living at the surface of the earth, or in air, the gelatine flowing from their muscle, as round them it hardens into a rete mucosum and into gristle, imbibes from within some substance calcareous or other which renders it more firm and more opaque. Such substances we already see in the coral which other zoophytes form round them.

Insects that live more in air, feed more on vegetable substances, and, from the greater quantity of carbon they take in, exsude into the rete mucosum that covers their muscle more matter ligneous or woody, transform their integuments into shells more light and aerial, of the same nature with the substance of which the wasps form their honeycombs.

In many mollusca and insects, after the first gelatine exsuding from their bodies has hardened round these in a shell or crust, what more afterwards flows out is spun into filaments which fix the mollusca to the surrounding rock, and enable it to ride safe at anchor in the midst of the surrounding waves, or suspend the caterpillar from the twig whence it swings at the will of the surrounding winds. Some animals, such as the silk-worm, wind these filaments round their bodies, and under the concealment of the coccoon undergo their transformations into flies and moths: others, like the spider, weave them

into the expanded web of which they afterwards occupy the centre, as a permanent habitation, and there tarry till in the extremities are entrapped the insects on which they subsist.

In these, and in other inferior animals, the first gelatinous matter exsuding from their muscle is no longer made round their bodies to form an indefinite detached lump, or aggregate of ramifications like those of coral, but is, by the resistance and pressure from without, condensed and moulded close to their bodies in as many pieces, separate from each other, placed side by side, as there are muscles from which it exsudes. Asterias and medusas only form round them a continuous bony integument or sheath. Univalves from their body exsude a single ossous tube which lengthens and widens with that body. In bivalves, from the opposite sides of their body exsudes matter which forms into two flat shells or trays, filled with calcareous matter, to the substance of which between the body and the layer of calcareous matter of the year before, every new year adds a new and more extended stratum.

Where animals have side by side a certain number of different muscles, from each of which is poured forth a certain quantity of gelatine, the gelatine of each hardens into an ossous plate, proportionate to the size and shape of the muscle, bounded by the ossous plates formed over the neighbouring muscles, and connected with these by the general epidermis under which all the

ossous plates are formed, and which, though connecting them, is pliant enough to yield to the movements, by the muscles given to that armour which protects them. Thus are formed the various pieces of the corslet or coat of armour of insects and crustacea. Thus are their pliant limbs shapened into a capability of performing different movements and actions outward, and of resisting actions and movements from without.

When that crust which, after consolidating and hardening can no longer grow, begins by its stationary size to confine the growing parts underneath, these parts by their pressure cause its different component pieces, only held together by the epidermis over them, to burst asunder, to be cast off, and, from the gelatine which continues to flow out of them, cause to be formed underneath a new coat of armour, roomier and better adapted to the increasing size of the animal.

Nay, when animals, like insects, first only endowed with a form simpler and less complex, requiring movements and actions less intricate, are made, in proportion as they grow, also to acquire a form more complex and more varied, requiring movements and actions likewise more varied, of their first ossous integument or shell the parts are often made, by the forming of a fresh epidermis more extended under them, and by the bursting of that over them, to be, like those of the scarabæus, lifted up without entirely detaching themselves, so as to give room occa-

sionally for this new rete mucosum to extend beyond its shield and to serve as wings. In the chrysalis of the butterfly the first horny envelope is, after a time, made to drop off entirely, and to display permanently to the air its new forms and its new faculties: to turn the entity from a worm, creeping on the solid ground, into an animal rising in the light atmosphere.

I have thus far only described the inferior animals in which the gelatine from within, driven outward, is made to form ossous concretions round the muscle at the surface of the body; but in those animals in whom a pressure from without and a suction from within more considerable would first produce a system vital, muscular and nervous more complex,—in whom upon and round the muscle the internal roots of these nerves would form a tissue or dermis more dense and thick, having nerves more multifarious, prolonged further inward,—the pressure of these ducts inward would also cause of the gelatine exsuding from the muscle a greater part to be driven inward, and to consolidate in ossous concretions in a different direction.

Already in many mollusca and insects, in which the bulk of the gelatine is still driven outward, and made to form an ossous sheath at the surface of the body, of that mucilage some lesser part would also be driven inward, till, meeting in earlier formations unconquerable obstacles, it

became by these resisted, and, between the pressure from without and the counterpressure from within, arrested, and made to accumulate and consolidate in various ossous lumps at a distance from each other.

Such ossous lumps we already find in oysters, under the name of pearls, and in most crustacea and insects.

As the nervous system became more developed—as the resistance of the nervous cord from within, by anticipation already called spinal, caused the gelatine, from without by the dermis pressed inward, to be internally resisted by this cord, it would by the same be moulded round its surface in as many different rings or sheaths as there were different distinct muscles from which it was poured forth; and these rings, ranged by the cord that run through them in a regular series, would compose a column protecting the spinal cord wherever this latter entered it; and which column would give greater firmness to the parts around, while by its articulations it still allowed these parts to obey the impulses and movements of the nerves.

The rings of this ossous sheath are called vertebræ, and where in animals the body is sufficiently ample, the materials of these rings are again extended and elongated in further excrescences called ribs.

Over the body, and in the face, the muscles

form the ossous concretions of the lower and upper jaw; and behind these anterior muscles the other muscles of the head form, over the brain, which is only the ultimate elongation of the nerves collected in the spine, the ossous plates of the skull. So much is the convexity of certain of these plates produced by the pressure inwards of the muscles outside them, and so much is it counteracted by the pressure from the parts withinside outward, that where an eye is early lost, the socket becomes, by the pressure from the brain within, obliterated. On the other hand, the skull of an idiot, in whom the brain remains less developed and less forcibly pressing outward, remains less ample and extended than that of entities in which all its organs receive their full developement.

Other ossous concretions would be formed in the lateral extremities anterior and posterior: in the arms and legs, the fingers and feet; and while the bones in the posterior limbs would be connected with those of the spine by the intervening plates of the pelvis, the bones in the anterior limbs would be connected with the same by the shoulder blades.

Different bones arising from different muscles are, by gradual growth, extension, and approximation made in different ways to join on to each other, to press within or lap over others, or to be with others gradually connected in one single

continuous mass; and when, by the efflux of the cerebral fluid through nerves outward, which is accompanied by a feeling of desire, or by the retraction of the cerebral fluid, already through the nerves outward poured into that muscle, which is accompanied by a feel of aversion, these nerves in the muscles produce movements of orgasm and protrusion, or of depression and retraction, these muscles communicating these movements to the bones, formed upon or within them, would cause these bones to be in their turn drawn out of, or reinstated into their pristine position, and by their reaction render the movements and actions of the muscles, themselves limber and soft, more firm, more precise and more definite; and as the muscles and the nerves were more multifarious and more closely knit, and as the latter offered to the gelatine flowing from the former a resistance more diversified and more powerful, the bones, moulded in forms more varied and more complex, would become capable of receiving from the nerves and muscles movements more fine, varied, complex and definite. In certain animals not only the gelatine given off by the blood, but some part of the blood itself, would later be driven to, and in the bone be made to form vessels; and, through the medium of these vessels, increase and accelerate the nourishment and growth of that bone.

In some animals, such as crustacea, from the

muscles of the stomach flows out a gelatine, which in that very stomach already consolidates into a sort of teeth. In later and higher animals a more vigorous pressure outward makes that gelatine rise to and only protrude from the jaws, and these animals form teeth better fitted to tear, to divide, and to bruise the solid substances and bodies taken into the mouth, before they are driven down into the stomach; and it is not singular that the stomach, being the earlier and more fundamental part out of whose later extension and growth arises the mouth, when in that mouth the gelatine is moulded into teeth, the pressure from the stomach should, with the counterpressure from without, mould those teeth in the shape best calculated to mince the elements from without, taken in for the further support of that stomach; and that from the mere inspection of the teeth we should be able to infer whether an animal is herbivorous, carnivorous or omnivorous.

In birds the gelatine exsuding from the jaw is only moulded into a continuous beak or bill.

In human beings, as the jaw enlarges, the first set of teeth, already very close, after a time become too condensed to be able to receive the further gelatine exsuding from the muscle. This gelatine then, arrested by these teeth, accumulates under them and forms new teeth, which in time push the former ones out of their sockets

and replace them. As in age these teeth shrink they fall out of the gums, in which then they are by no fresh gelatine replaced.

Even in most of the animals in which a portion of the gelatine flowing from the muscle began to be driven inwards, and to be compressed into the internal bones of a spine and others, of this gelatine another part would still continue to be poured outward, and, over the surface of the muscle and dermis, and under or athwart the very pores of the epidermis itself, with external elements to be mixed, combined and consolidated in external concretions which, according as they were by external pressure left to remain more conglomerate, or were made to become more divided, end in a single continuous shell, or in a number of more minute and partial plates, scales, or fibres, called fur, wool, bristles, hair or feathers.

Already some mere insects, such as moths and butterflies, have hair, down and feathers proportionate to their diminutive size. The fish in general have scales which lap over the root of those underneath, and have their own roots concealed by those that grow over them; many amphibious animals have plates which fit on to each other; and only in a few of the tortoise species is the gelatine so entirely driven inwards, as to leave them entirely destitute of external shield and basin.

Most quadrupeds still have a thick coat of fur, wool, hair or bristles. In most birds the finer texture of the gelatine from within, and the more divided pressure upon it of the air from without, makes these bristles ramify into feathers. Those of the cassowary remain fibreless.

From those ridges and extremities of the body, from which flows out a greater abundance of gelatine, it consolidates into forms more extended and more elongated, as in fishes in the fins of the back and belly, in beasts in the hair of the mane and tail, and in birds in the plumage that extends from the pinions and that grows from the rump. In man, in whom more of the gelatine is by suction carried inwards, only enough is left going outward to form a dense covering of hair to the cranium and to certain other more juicy parts of the body, and over the remainder only to leave a hardly perceptible down, though so near to the formation of bristles still remains that very down, that certain individuals of the human race have been seen entirely covered with the spikes of a porcupine.

In higher animals, not only from the stomach is driven to the anterior extremity or mouth the torrent of gelatine forming the teeth, but to the lateral extremities, anterior and posterior, are driven the other torrents of gelatine, which, with elements from without combine and consolidate

into the hoofs or nails. These nails, like the teeth, proceeding from the stomach, have the same analogy which the teeth themselves have to the wants of the stomach. In herbivorous animals they are obtuse and clumsy hoofs only, capable of affording mere support; in carnivorous animals they are nails, capable moreover of prehension and of tearing; and in man, endowed with omnivorous faculties, they preserve the medium between the two extremes.

In some animals from other parts still exsude excrescences which become horny; and like the scales, hair and feathers, in many animals these horns after a time become too dense to admit of further influx of the gelatine which continues exsuding from the body. It then accumulates under their roots, there hardens, pushes them off, and replaces them.

We have seen that the very first organized and living entities already from within drove out a siliceous matter, which between and over the various organs hardened into a transparent and porous integument, called epidermis, through which the later inhalations entered and exhalations issued; and where through the pores of the first epidermis flow out such exhalations as are formed into further solid excrescences, a new sheath of epidermis ever again covers these. In inferior animals, who take in much of this sili-

ceous matter, part of it on exsuding elongates in the wings, which we see in gnats, flies, bees, beetles, and even bats.

This integ ment, which over the eye assumes the name of cornea, to the last continues to remain to the different organs, and to the whole surface which it covers an ægis which, unless force is used, only lets of external elements as much penetrate athwart it as benefits the parts within. As it is exposed to more friction and resistance from without, it becomes denser, harder and more capable of resisting that friction. In old age, when the parts within shrink, that epidermis often sits over them in wrinkles.

CHAPTER XXXIII.

Excrementitious substances.

Already of the various elements that are radiated through the atmosphere, different sorts sucked in by different plants, are by these vegetables condensed in oils, essences and balsams, sometimes very sweet or pungent, sedative or stimulant, which again from their axillæ, leaves, flowers and other parts, are driven out and made to exhale.

In smaller animals, especially of an aerial sort, similar elements are absorbed and are again from similar parts in a more condensed state emitted. Already in water the sepia thus takes in the substance which, by the inky hue it contracts when in the agitation of the animal's flight it escapes, covers its retreat. But especially insects when, issuing from the egg they rise in air, inhale a variety of such substances. These substances when in them they accumulate in great quantities often acquire a powerful pungency. They form vessels, and through these vessels, according as the pressure is greater forward or backward, they are again let out through the proboscis or the opposite extremity in the form

of a sting. When the animal is irritated this tube or sting stiffens, pours out its contents, and when in contact with softer bodies, in them makes a wound through which those contents are made to flow in that body. Innocuous to the body by which they were attracted, and in which they were made to accumulate, they generally by their pungency act as a poison on the strange body in which they are introduced, and nauseate more senses than one.

Thus the fly, the mosquito, the bee, and the wasp have their virus and sting, of whose use in hot weather they become more than usually liberal. The bee often from the flowers it sucks brings home this virus in the shape of poisoned honey. The beetle and the bug cause this venom to inflame the swellings their sting produces; and the ant secretes an acid so powerful, that when the animal attempts to cross a line of chalk, the effervescence it causes in this line singes its own legs. The spider with its effluvia first torpifies the fly, which afterwards it devours. The yulus, when alarmed, pours forth emanations so pestilent as by their mere odour to repel its pursuers, and the bracchinus crepitans of these emanations lets out entire volleys. Nay, the females of the fire-fly and glow-worm of the very light and colours they imbibed imperceptibly during the daytime at night again emit part in a more condensed and visible shape, and thus

hold out a beacon to the males that pursue them.

Certain fishes and reptiles still in the same way cause the elements they take in to be by powerful explosions let out. This we see in the torpedo and the gymnotis, which, of the electricity they inhale, when irritated let out such quantities as cause violent shocks.

Bating these few exceptions, even in the regions where the sun sends forth its various elements in the greatest abundance, toads, vipers, and other small reptiles are the largest animals that imbibe certain elements in a shape so condensed as on emission to become venomous; larger animals, no longer wanting these means of defence, no longer on ordinary occasions possess them: only when by extraordinary excitement and irritation their fluids are curdled and decomposed, they acquire that fatal power, sometimes felt from the bite of a rabid dog or cat.

On the different ways in which the elements from the blood exsuded are under the transparent epidermis brought in contact with the rays of light from without, and are with these rays recombined, depend the hues which through the cuticle the various integuments of the body itself —the scales, hair, plumage, or skin exhibit. To such causes is owing the opalescence of the oyster shell, the metallic lustre of the fish and beetle, the velvet hues of the butterfly, the more modest

tints of the beast, the spots of the tiger, the stripes of the zebra, the azure and the scarlet reflexes of the bird, the mock eyes that are strewed over the tail of the peacock, and the colours that mark the iris in the real eyes of all animals. To such also are owing in the human race the varied hues of the copper-coloured Caraïb, the olive of the Malay, the black of the negro, and the rich complexion of the European.

Where in certain animals, such as mice and magpies, rooks and rabbits, nay certain human beings of races naturally dark, peculiar individuals remain albinos, it is that the elements which produce colour are not by the blood exsuded in sufficient quantities; and where with age the parts of these animals turn gray and white, it is that these parts, shrinking and dry, no longer from within afford transit to those elements.

CHAPTER XXXIV.

Instruments of sound at the outside, and instruments of voice at the inside of the animal frame.

Besides the organs of voluntary movement, through means of which animals re-act more directly on external objects inanimate and animated, some animals have organs of movement which produce sounds, through the medium of which they act more circuitously on other animals only.

The animals only destined to live in water—those only able, from the density of the element forming and surrounding them, even to hear the vibrations of sound very indistinctly, have not yet in any of their organs sufficient elasticity themselves to produce vibrations of sound. Nearly deaf, they are entirely dumb. Fortunately they want not those organs of sound they possess not. The inferior sorts are hermaphrodites; and in those in which the sexes are divided, the male, when moved by sexual desires, need not seek the female, nor make her proposals. She conceives and lay her eggs without his co-opera-

tion. He is attracted by and fertilises these eggs without her consent.

But already insects, more aerial in their substances, derive from the element in which they live that greater elasticity which produces in them external husks and integuments hard and dry, capable of strong friction and vibrations; and the same superior elasticity which enables them to produce vibrations of sound more distinct, also enables them to be by such vibrations, when by others produced through the medium of air, more distinctly affected: enables the females to receive, through their organs of hearing, excitements similar to those which made the males produce the sounds arising from such excitements. Without yet knowing whence the call of the males proceeds, the females, by the emotions it excites in them, are made to approach and to answer that call. The mechanical and monotonous sounds produced by external instruments, however, still only resemble the harsh and unmodulated clickings of a clock, gratings of a file, or grindings of a wheel: they are incapable of modulation.

Higher animals, who had softer and more pliant integuments, would no longer only be able from their outer surface to produce mere mechanical noises: they would, when in moments of agitation they emitted from their internal lungs, through their larynx, mouth and lips, columns

of air more copious than usual, with the muscles of the throat so strike that air, as to cause from within those vibrations of sound deeper and more varied, called voice. Yet in reptiles, that voice itself still has little modulation; that of frogs is only a hoarse croaking, that of serpents a harsh hissing.

In beasts endowed with muscles of throat and mouth more elastic and complex, and capable of movements more varied, the voice already becomes in its intonations and expression more forcible and more diversified.

But peculiarly in certain of those more aerial animals called birds, that greater quantity of air, at the same time that it renders their feelings more acute, renders their muscles of movement so much more elastic and flexible, that, when through their sympathetic nerves the cerebral fluid acts on their lungs and throat more finely organised, through these parts are produced in the male sounds more distinct, more varied, more strongly affecting, and more instantaneously responded to, by the female.

Some birds are even by the sounds emitted by other entities of their species so strongly impressed, that these sounds excite in their organs of voice movements calculated to produce similar sounds. The bullfinch still only produces such imitative sounds as are inarticulate. The parrot and the magpie imitate articulate sounds.

In the human being different mental emotions, acting differently on the organs of voice, through means of these organs first produce different natural and inarticulate cries. When human beings first begin to feel desires and emotions, at once individually too feeble and too indefinite, and collectively too complex and varied, to be expressed by these mere natural cries, their powers of abstraction and reason suggested to them the idea of inventing and composing other noises no longer produced by the mere solicitation of nature, but by the instigations of art, more complex and varied than the former, as the readiest mode of representing these emotions and desires, and that which arose most naturally out of inarticulate cries themselves. These signs they made intelligible to those that were to understand them by accompanying gestures. Man prompted by lust would then, instead of knocking a woman down, and ravishing her by force, ask her consent to his wishes. The infant prompted by hunger would then, instead of grasping the mother's nipple, request of her to gratify his appetite, do the same, by sounds which would elicit from her other sounds signifying that she gave or refused the boon demanded. Thus would begin artificial and conventional language.

Thus only by elements from without made to meet, to combine, to be by other later elements

from without again decombined and driven out, and in their way outward with new elements from without, over the former combinations made to meet, to combine and again to flow inwards, are life vegetable and animal, sensation, thought, will, and voluntary reaction outward on external surrounding objects and modifications first produced, and next made to increase and to develope.

Helvetius has supposed that the preeminence of man over brutes only arises from the superiority of his external organs of action; that, for instance, only from the finer organization of his fingers he is able to knit. Helvetius seems to have forgotten that Voltaire and Newton have produced works of intellect with which the agility of the fingers had nothing to do; and that where the agility of the fingers contribute to the superior execution, the mind must first have produced the superior invention. Nay that it is only out of the later reaction outward of the superior organization of the internal instruments of the mind, that ultimately arise the superior executive powers of the body.

CHAPTER XXXV.

Although every organ has its definite prior causes, every organ seems not yet to have its definite later purposes.

NOTWITHSTANDING we generally find in most animals, for the peculiar purposes wanted the peculiar definite means also provided, we often find the means not sufficiently developed to produce the purposes seemingly intended. Thus there are many brutes which with the rudiments of legs and wings never have these abortive organs sufficiently developed to walk or fly. Cetacea never acquire anterior extremities sufficiently elongated to move on dry land; and in pinguins the pinions do not develope sufficiently to buoy them up in air. We must, however, suppose that even in these animals those parts already answer certain purposes of utility and benefit, unknown to us, though they cannot yet answer those ultimate more evident purposes for which according to our ideas they alone seem destined.

Nor is in animals each peculiar organ yet so pointedly destined to a peculiar purpose, but what in different species of entities the same

sort of organs serve for different purposes, and different species of organs serve for the same purposes.

Ascidia, for instance, through their gills take in both air and solid food: fishes only through their gills take in air, and leave to the mouth the task of taking in the more substantial liquids and more solid food. Reptiles, beasts, and birds on the contrary take in not only solid and liquid food, but even air through the mouth, and only leave the contraction of the gills, which form the eustachian tube and ear, to take in the vibrations of sound.

In many mollusca of the rete mucosum the elongation forms sails which, puffed up by the wind, assist the animal to cleave the waves. In many insects this rete mucosum forms wings able to buoy them up in air. In fishes this rete mucosum again forms the fins, and in certain of the quadrupeds, called bats, it equally forms the wings.

In fishes and in birds the nether extremity or tail elongates in a rudder to steer their course through water or air. In the beaver it becomes a mason's trowel; and in the monkey a fifth hand, with which to grasp branches and boughs.

These are shifts of nature, originating in the imperfections of this world, which probably in a higher and more perfect globe will no longer be necessary.

CHAPTER XXXVI.

Organs of sense in brutes more acute than in human beings.

From the peculiar construction of brutes those of each species seem to have the organs of some peculiar sense more developed and more acute in its faculties than are the corresponding organs and faculties of man, precisely because each species of brute still has the organs of the peculiar sense it excels in less interfered with by the organs of other different senses, and by the later organs of the mind, the formation of which draws off materials from the formation and finish of those of the external sense,—because the brute not yet having the materials of organs of sense and mind so much divided and diffused between different sorts of organs, those of each sort which they possess, seem susceptible of receiving impressions more forcible and more lasting. External modifications which glide over the sense and mind of man unperceived, penetrate deeply into those of brutes, and make on them a profound impression. Thus the inferior brutes seem more acutely to feel the impressions of

electricity: most of the higher animals seem more acutely to feel certain impressions of smell, proceeding from the elements that enter greatly in their first composition, and that are most necessary for their further support: many birds have organs of hearing more delicate: and certain of the higher beasts and birds have organs of sight more acute and more quick. The hawk sees in the daytime objects more minute and more distant than man sees; the owl and the cat see better at night; and the monkey seems to possess organs of sight at all times susceptible of impressions more intense and more rapid. It is through these only that he is led to perform those movements, which we take for intentional mimicry.

In general, of all brutes the higher classes of monkeys seem in internal organs of intellect, and in external organs of voluntary action, to approach nearest to human beings. The baboon already can stand and walk erect, and resembles man most in his gait and actions. Still as his mind within developes not yet in organs and faculties of reason, his body without developes not yet in those organs and faculties of voluntary action, which only grow out of organs and faculties of abstraction. His body still is disfigured by an enormous belly: his face, whether seen in front or in profile, still has features little marked, little distinct, little

expressive. His extremities are still deprived of divaricating muscles. He cannot bend his arms separately either backward or forward. Able only with his limbs to hug, he cannot embrace or encircle an object. In his hand he cannot oppose the thumb to the fingers. Allowed, consequently, only to grasp firmly a cylindrical body, a stick, he can neither point to a distant object with a single finger, hold a ball, inflict a pinch, nor play on the piano or harp. His legs and feet labour under corresponding inabilities. Able to crouch, to fold his nether limbs together, he cannot divaricate, expand, or cross them, so as to bestride a horse or cut a caper. His feet have no instep, no heel, not even a sole capable of resting fully on level ground. He is more fit for clambering on trees than for walking on a plane surface.

Thence only when secure and at age, he assumes the erect posture of man, as an occasional indulgence. As soon as pursued he forsakes his more imposing attitude, drops the man, falls on all fours, and scampers away the brute.

Of powers of voice he has none. As if afraid to render the resemblance to man too great, and too liable to confusion, by giving him what the parrot already possesses, nature has denied him that boon. He can only bustle, grin and chatter. In vain does he move, act, dress, and eat like man. If he attempts even to cry, the air driven

out from his lungs is again lost in his larynx: he remains mute.

Not so well proportioned, or so handsome as man, he labours under the additional disadvantage that other brutes are only in their forms and faculties compared with lower brutes, to which they appear superior; while he, from his near approach to man, is compared with man only, and therefore appears inferior, deficient and positively ugly.

CHAPTER XXXVII.

Gradations in the superiority of the natural organization of human beings over that of brutes.

I HAVE already early in this work stated that even Genesis, so far from opposing favours the belief that besides the human race, of which the Bible gives the history, as having been the most favoured by Providence, there arose other inferior human races, wholly distinct from the same; that peculiar regions had, like their peculiar vegetable and brute races, their peculiar races also of human beings, particularly suited to them; and, in proportion as they were more particularly suited to them, in the same proportion also less suited to other regions, again very different from the former in climate, in temperature, in soil and in situation.

In fact, we cannot help supposing that, if in every climate and region the first component elements of human beings have been diffused through the atmosphere, and spread over the earth in sufficient quantities, as they seem to have been, afterwards to support the number of human beings which we actually have seen covering this earth, these elements must at first, and while yet unappropriated to such beings, have

spontaneously, and without miracle, been made in different regions to combine into the first embryos, and into the later successive developments of more than one pair; and that it only was after of human beings, as of vegetables and of brutes, a certain number had been thus spontaneously combined into primary human individuals, that the elements of such beings became in their unappropriated state sufficiently rare and distant, no longer to be combinable into new individuals except through the attraction, medium and suction, more forcible and more distantly acting, of prior human beings already existing.

This is in fact the only natural and thus rational way of accounting for existence of the number of races of human beings, wholly different from each other, and each peculiarly adapted to the peculiar regions and climates in which they seem indigenous, which still propagate on this globe.

These races, so different from each other, and each so peculiarly suited to the peculiar regions and climates in which they are found—so peculiarly ill adapted to other regions very different from those former ones—cannot have originated in a single couple, cannot have had their primitive nature, physical as well as moral, only subsequently altered by the later difference of temperature, soil and mode of living which they experienced. Of this single couple the various descendants cannot well have acquired the pecu-

liarities, internal as well as external, some of woolly-haired negroes, others of lank-haired Calmoucks and Malays, others again of copper-coloured Americans, as different from each other in their inmost organization as in their outermost hue—in their mental capabilities and disposition as in their bodily frame and constitution; for if the subsequent deviations from their original abode and mode of living had alone been capable of producing in them such subsequent deviations from the original type, other still later returns to the original situation and climate, would also alone again have been able by degrees to bring them back to their original type; and of this occurrence we have no example; this event never happens.

No race of negroes has ever in any of the regions, which seem peculiarly appropriate to the production of whites, by any number of intervening gradations been, through the mere influence of the climate, the temperature, the mode of life, the diet, or any other cause short of the repeated crossing of breeds—the repeated combination of elements of the black, with elements of the white species—been made to pass over into a white race.

Without that condition, even in Lapland negroes still only propagate negroes, and on the coast of Guinea Samoyedes still only propagate Samoyedes, as long as the current of propagation

is not entirely stopped; for a race transported so far from its natural home, to a region so very different in climate and in soil, after a time no longer propagates at all, except by mixing with a race more suited to the country;—becomes entirely extinct in the first or second generation.

For many centuries African blacks have constantly been imported in Turkey and in Greece, and still new importations are in those regions as much needed as ever to keep up the breed: no negroes have taken root in the soil, and been able to continue the succession of domestic slaves; and it is only the races, indigenous in latitudes between the opposite extremes of heat and of cold, that, less distant from either, can by degrees accustom themselves to both.

Moreover, if all the various races of men now existing had originated in a single couple, there would have remained only a single original artificial and conventional language, at least wherever that language had not, by a miraculous confusion of tongues, been subsequently made to ramify into different dialects. As races remained in their modes and manners more in a state of mere nature, and less remodified by art, they would have retained the artificial and conventional language of the primitive couple with least alteration; they would to the last have understood each other better.

But the reverse of this is precisely what takes place. In the widest regions, the races most savage, least emerging from a state of mere nature, are precisely those of which the smallest tribes, different from each other, each have their artificial and conventional language, however poor and restricted, most different in its very roots from that of each of the others; most unintelligible to each of the others; most strongly proving that in its origin it was different from that of each of the others, and that of course the origin of each tribe itself was different and distinct from that of each of the others. It is only as races, by spreading more, and becoming more civilized, approach and blend more with each other, and more interchange inventions, that with these inventions they also more borrow from each other more of the representative signs or words, by which their ideas, notions and possessions are represented;—that their languages, different in their first roots, in their later superstructures become more assimilated.

Some savans that have yielded to the necessity of recognizing a number of human races, distinct and different from each other, have yet limited the number of these: Linnæus to five, Dumenil to six, Cuvier to three, Desmoulins to eleven, Bory de St. Vincent to fifteen. But it is clear that these limitations cannot be founded on just grounds; that as soon as from the consideration

that every region would, as well as of vegetable and brute productions, of human races also have its appropriate sorts, produced by the very indigenous elements of the region, and consequently peculiarly adapted to the same, and as soon as we prove by experience that such must have in reality arisen, we must also believe that in every region these have arisen in proportion to the richness of the atmosphere and soil; that thus, while in soils and atmospheres very poor and sterile, primary individuals arising spontaneously out of the elements of the soil, would only have arisen at such great distances from each other, out of elements so differently modified, and in such small numbers, as to render it possible of their later descendants to pronounce which could, and which could not, have arisen out of the same primeval couple, in other soils and atmospheres very rich and fertile, primary individuals arising spontaneously out of the elements of the soil, would have arisen so near each other, out of elements so resembling each other in their modifications, and in such great numbers, as to render it impossible of their later descendants to pronounce which must have arisen out of the same identical primeval couple, and which need only have arisen out of some other primeval couple resembling that first.

We may thus suppose that on this globe every nook and corner, containing a sufficiency of the

elements necessary to combine into the first embryos of human beings, has, where these were approximated, produced out of them the sort of beings suited to the soil and climate; that, if there were not elements sufficient to support and increase all those individuals first formed, some have again subsequently been for want of support condemned to perish, and that others have been enabled to increase and to propagate.

As of monkeys the higher sorts seem only the last and highest of brutes, produced prior to human beings, so of human beings themselves some species seem only the rude sketch of that ideal which nature has reached in others; but what may at first sight seem extraordinary is, that precisely in the latitudes in which naturally arise the highest of brutes—the orang-outang, or wild man of the mountains—namely, the regions of Austral Asia—seem precisely to have been those in which the human race itself remained lowest and least perfect in body and in mind: as if in those regions nature had wasted so much of its richest elements on the brute creation, as to have had but little left to expend on the still higher human race.

Of the different human races once spontaneously produced, many have since probably again been entirely destroyed, whether in their first infancy, or at later subsequent periods, by

the fury of the elements, the ravenousness of wild beasts, or the rage of other human beings themselves, of which the higher races, as they more extend and want more room and substance, generally end by destroying the lower tribes, and ultimately leave no trace of these.

Of the latter, however, there still are enough left to justify my hypothesis, and of these I shall describe a few by way of example.

CHAPTER XXXVIII.

Varieties of human races.

In the inland fastnesses of Borneo and Sumatra, and over the islands of the Polynesia, still rove, perhaps soon entirely to disappear from the globe, tribes of which the resemblance to the baboon is most striking, the superiority over the brute, in mind and body, least perceptible. In them, of all human beings, the organs of vitality most early and fundamental—those named abdominal—still present the greatest expansion; those of reaction and movement, superstructed on the first, still display the least possible development and finish. The external seats of those lower senses which still remain most directly connected with the wants of the stomach—the tongue, the jaws, the lips and the nostrils—still preserve the most disgusting amplitude, openness and spread; the organs of the higher senses, still often exhibit an equally disagreeable and repulsive obliquity and want of room. The face, from a preposterous width above, terminates abruptly underneath in a sharp, cheekless, chinless point. The organs of intellect still appear in their narrow

cramped receptacle wholly undeveloped. Of the rude ill-formed skull the anterior part—that which, in proportion as it is better arched, gives earnest of organs of thought more expanded—is still so low, so narrow, so depressed, that it can hardly be said to form a distinct forehead. The small deep sunk eyes, like those of the baboon, still keep constantly vibrating in their narrow sockets. The flat, wide, staring nostrils, are scarce by any thing but their yawning orifices distinguishable from the pouches more prominent than the nose, over which they are spread. The skinny chasm of the enormous lipless mouth is armed with teeth long, projecting and wide apart, like the teeth of a saw. Of chin there is no sign. The face, hideous when viewed in front, is not less frightful when seen in profile; its greatest prominence is in the region of the mouth. The head, sunk between the raised shoulders, has not room over these to turn sideways. A trunk of enormous bulk supports arms meagre and deformed, of a finny shortness or uncouth elongation. That trunk moves on thighs and legs short, bowed, crooked and calfless. These supports in their turn are ill at rest on feet flat and square, deprived of instep and of heel, and more calculated, by their want of well-formed sole, to entwine themselves round branches than to walk on level ground. The utmost height of these misshapen mortals in general scarce reaches four

feet nine. Their ill-marked muscle is hardly discernible athwart their coarse dusky hide, as distant in its hue from a fine glossy black, as it is from a clear transparent whiteness. The skin is frequently covered with irregular patches of wiry hair or bristles. Their limbs seem unhinged, their movements performed by abrupt jerks. They crouch rather than they sit; they climb better than they walk. Their features have not yet a finish sufficient to mark the distinction between youth and age. In childhood they already look decrepit. Nor do their countenances yet possess sufficient flexibility to mark the transition from calmness to irritation. Little sensible to emotions even of physical pleasure, they are less alive still to feelings of bodily pain. They undergo the greatest hardships without being by their sufferings stimulated to mend their lot; they feed without repugnance on the coarsest garbage; encounter without nausea the most disgusting smells; are inaccessible to any pleasures of the ear or eye; have little memory, and less imagination. They seem incapable of reflection on the past, or of foresight into the future. Unmoved by any prospect of distant benefit, undeterred by any threat of remote injury, they are never seen to express joy, or to denote grief—to laugh or to cry. Only accessible to hunger, while that feeling pinches not their vitals past endurance, nothing ruffles

their apathy. Like the brute they are, while in a state of repletion, wholly incapable of providing for the hour of want. Unfeeling for themselves, they cannot be expected to sympathise with the feelings of others. None yet has a wife or a child he calls his own. The female, wooed with a club, when from a means of pleasure she becomes an incumbrance, is by that club despatched. The offspring is left to shift for itself.

Cruel, cowardly and credulous, they are void of curiosity and inaccessible to wonder. Nothing occupying their thoughts sufficiently to become familiar to them, nothing can seem strange. They show no mental faculty beyond that low cunning, already by man attributed to monkeys. When inveigled in the trammels of civilization, they only labour to effect their escape. Incapable of inventions of art with which to supply the deficiencies of nature, they possess neither utensils nor arms. Inland they feed on the grub that crawls forth from the earth: near the seaside on the oyster left exposed by the surf. They go completely naked: they have no permanent abode. In the daytime they prowl about in perfect solitude, at night they creep under the sand. Their speech consists in a few hoarse [illegible]akings: but by men who have no ideas [illegible]gs to communicate to each other, even th[illegible]e seldom uttered. If clothed by

force they tear off their apparel. If caught they try to get loose. The best treatment cannot tame them. When detained they soon, without apparent grief or pain, pine away and die.

Of the New Zealander the skull presents a texture so coarse, a form so contracted, so similar to that of the orang-outang, that anatomists have considered him as the connecting link between the monkey and man.

From the Andaman islands in the Indian Archipelago were once brought away in an Indian junk two middle-aged savages of a peculiar tribe, black and woolly-haired, the tallest of which scarce reached four feet seven, and only weighed seventy-six pounds. Protuberant in the paunch, stunted in the extremities, of voracious appetite and cannibal propensities, climbing on trees as nimbly as quadrumana, diving under water as readily as ducks, heavy and dull in intellect, and, when by themselves, setting up a cackling like turkeys, they only appeared seldom even in their guttural hiss to converse with each other.

In the interior of Luconia and throughout the Indian Archipelago there are vestiges of a black woolly-haired race of pigmies, incapable of the least approach to civilisation, unpossessed of any permanent abode, and when caught, however well used, either soon effecting their escape, or pining to death. Of these the major part have, by a different race of a brown hue, with

long lank hair, and endowed with superior mental capacities, found in the same regions, been hunted down, or forced to fly to inaccessible fastnesses, where gradually the race melts away.

In New Holland and in New South Wales, almost every tribe of natives, however small, has an idiom of its own different from that of the neighbouring tribes, and only consisting of a few sibilating sounds, unintelligible out of the tribe. Of these tribes some are hideously ugly. They have noses quite flat to the face like those of brutes, or only noseless nostrils very wide, which entirely want all distinct projection. Their eyes, very close to each other, and deep sunk in the head, constantly vibrate like those of the monkey. Their mouth is extravagantly wide and prominent, their body clumsy and ill formed; their arms, almost fleshless, are of enormous length: their legs equally ungainly; and a rough wrinkled black skin seems ill to fit the ill-limbed body. They live upon ants nests, wild honey, roots and berries: at night they creep into some hollow tree. The males destroy the females, and the females their offspring, when tired of the incumbrance.

Once from the interior of Africa was brought to the West Indies a whole cargo of captured negroes, so inferior in organization to the general average of blacks, so hideous in face, so misshapen in figure, so short, so deficient in what-

ever distinguishes human beings from brutes, that they could not find any purchaser. They resembled the natives of Old Calabar, residing not far from the coast of Guinea, who have foreheads and chins almost obliterated; cheeks or rather pouches projecting beyond the nose, wide, prominent, lipless mouths, armed with long sharp tusks or teeth standing out; eyes almost in contact with each other; bellies that hang down over their thighs; a chest very narrow, arms of prodigious length, thighs extremely short, spider legs void of calves, and splay feet as ill-fitted to stand firm on even ground as those of the neighbouring monkeys.

Near the Cape, intermingled with the higher race of Hottentots, are the Bosjes-men, of which the males scarce attain a height of four feet six inches, and the females of four feet. They become decrepit and wrinkled at what among whites would scarce be deemed a mature age. Their noses are flat to the face, their eyes in constant motion like those of monkeys: from their broad cheek-bones their faces taper down to a sharp point: their hair is woolly, their coarse brown skin usually besmeared with grease, and their body begirt with the decaying entrails of the animals they have devoured. The females in some parts of their frame are meagre and stunted, in others they exhibit an exuberance similar to that of the Caramanian sheep. Their

posterior excrescence is often balanced by a natural apron before similar to the pouch in which the kangaroo nurses its young. They sleep, seldom two nights running, in nests which they contrive in the bushes; are equally strangers to the use of fig-leaves and of fire. Apathic but fearful, and not even possessed of the intelligence required in slaves, they spend their time either prowling about in perfect solitude like wild beasts, or crouched like monkeys in a circle, exhibiting an unmeaning grin or an inarticulate chatter.

But enough of the very lowest specimens of the human race, which every where exhibit a great sameness both in their physical drawbacks and moral deficiencies. Even in certain negro races of a very superior cast to these, while there still remains, as in certain brute races, of the olfactory, optic and fifth pair of nerves, a development much greater, a power of conveying sensations of smell, sound and sight, in certain respects much more acute than is found in higher human beings, there still remains to the monkey a nearer affinity in other organs and parts internal and external;—in the marked contraction and want of room in the brain, thickness of the skull, height and size of the flapping ear, yellow opacity of the eye-balls, incessant vibration of the eyes, and depressed expansion of the nasal cavities over hollow cheekless pouches; in the

skinny projecting mouth, armed with wide rows of threatening teeth, under which dives away a chin almost obliterated; in the angularity of the shoulders, length of the fore-arm, square obtuseness of the hand, crookedness of the thigh-bone, gibbosity of the tibia, height and smallness of the calf, flatness of the heel and instep, uneven bearing of the sole both longways and broadways, spareness of the muscle, duskiness of the skin, and tendency of all the parts to a leaning forward, in its turn producing a preference of a crouching to a sitting posture, and a superiority in the movements of diving and of climbing, over those of walking and running, greater than are possessed by higher races. Most negro tribes may still be said to display in their forms a want of fulness, in their movements a want of precision, in their joints a want of hinging, in their articulations a looseness, very remarkable. Their arms swing, their legs shuffle along, and, as their bodies seem callous, their minds seem inert. They appear wholly incapable of deep abstraction. Nowhere have they, through an innate force, and unassisted by the prior examples and precepts of white races, attained any degree of advancement in science, or of refinement in art. As in every thing the opposite extremes ever precede the just medium, negroes are in their own native regions still ever found either wholly unshackled by any social

control, or smarting under the lash of the most unmodified despotism. They either recognise no bond of union, or obey with the most abject submission the most unbridled tyrants. They either live wholly unawakened to any sense of superhuman guidance, or they exhibit the most senseless superstition and faith in the silly tricks of sorcery. Their worship is only a worship of fear: it is only addressed to spirits of evil, whose wrath they strive to avert merely by streams of blood. They have not yet a religion of love, a reverence for an author of good, whose favour is only to be gained by rooting out the ill propensities of the heart. Ages roll over their monotonous existence without producing in their mind the least cultivation, in their manners the least improvement.

Even among black races however, though all originally alike produced by, and all evidently only calculated for climates where prevail the extreme of heat, there may already be discerned many degrees of excellence. The highest of negro tribes are in some respects not only equal but superior to the lowest of white races.

There are in Africa, to the north of the line, certain Nubian nations, as there are to the south of the line certain Caffre tribes, whose figures, nay even whose features, might in point of form serve as models for those of an Apollo. Their stature is lofty, their frame elegant and powerful.

Their chest open and wide; their extremities muscular and yet delicate. They have foreheads arched and expanded, eyes full, and conveying an expression of intelligence and feeling: high narrow noses, small mouths and pouting lips. Their complexion indeed still is dark, but it is the glossy black of marble or of jet, conveying to the touch sensations more voluptuous even than those of the most resplendent white.

CHAPTER XXXIX.

Further examples of the differences physical and mental of different human races.

As the examples of the differences between certain human tribes and others lead me to races higher, and having an organization of body and of mind more flexible, I find it necessary more to distinguish the characteristics that are given them directly by mere nature from those which are superadded by later art, since the latter, well conducted, may raise individuals higher above their earlier natural pitch, and on the contrary, ill conducted, may sink them lower beneath their natural standard.

Like the extremes of heat the extremes of cold still have produced human races, pointedly and exclusively adapted to the regions in which they first arose. The Samoyedes seem as little able to support life on the coast of Guinea as the negroes of the Gold Coast seem able to live near the poles. Only the auctothones of the intervening more temperate regions, less distant from either extreme, seem able to a certain degree to brave both the cold of the one and the heat of the other: and even that but imperfectly, as we have found at Sierra Leone. Like the lowest of

the tropical races, the lowest of the hyperborean races still seem to show the inferior combination of the elements of which they are composed, in all their forms and habits. The Samoyede still has a skull depressed and shapeless; hair lank, oily and coarse. His dim half-closed eyes form with each other an angle, descending over his flat misshapen nose. His cheek-bones protrude preposterously. His head, seen sideways, rests obliquely on his curved spine. His body is bloated, and his extremities seem consumptive. His arms and legs are crooked and ill formed: they appear the rude performances of some bungling artificer. His stature is squat and dwarfish; his complexion swarthy; his skin from infancy so shrivelled that before he attains manhood he seems to verge on extreme old age. The female is only distinguishable from the male by her dugs, which hang down to her navel, when not flung over her shoulders, in order to support the infant suspended from her back. Feasting on the remains of the dead whales cast on their shores, the Samoyedes, like their dogs, growl when approached during their meals, and, like dogs, approach their own females for carnal purposes in the sight of strangers. Their short summers they waste, when they can, in intemperance: their long winters they sleep away. The smallest opposition to their momentary whims renders them furious; the weightiest considerations of future

welfare hardly make them stir a step. Frightened at a shadow, their cowardice equals their irritability. Of human laws they are ignorant: of divine laws heedless. Their deity is a black cat; their worship, the slaying of their cattle and captives. So unsuited is their frame to any climate milder than their own, that even the temperature of Denmark and Norway is to them mortal.

In the new as in the old world there still remain vestiges of nations which bear the marks of original inferiority of organization, variously modified, strong upon them. Among these are the red or copper coloured tribes, of which some are also found in Africa. So torpid are in some of these, and especially in the Caraibs, the vital functions, that they can for whole days remain deprived of food, ere the cravings of hunger induce them to make the least exertion for the purpose of seeking sustenance, though, when food is at hand, they gorge till repletion alone forces them to leave off, and to lie down motionless till digestion is performed. As slow in their productive as in their consuming powers, their sexual frigidity at first excited the wonder of the more ardent Spaniards. Only capable of being stimulated to exertion by a present bodily stimulus, they are unable to be, by the mere recollection of the most pinching past wants, made to guard against future privations. Only having advanced to the most primitive arts of hunting

and fishing, they disdain the labours lighter but more regular of the shepherd and the husbandman. Consequently they by turns lie in complete torpor, or endure the utmost fatigue: alternately suffer the extremes of want, or wallow in beastly excess. At a single meal they consume the provision of a month, and are content to pay for their intemperance by as long a period of abstinence. In the morning, on rising, for an intoxicating draught they give away the mat which on going to sleep they will again want: when unengaged in the chase, or in warfare, they sit for whole days close huddled together in a circle, not for the sake of society, or mental companionship, but for that of mere bodily warmth; as silent and indeed as solitary as if they were alone. There is between them only physical contact, not intellectual communication, interchange of ideas. Their eyes are fixed on vacancy: their intellects in abeyance. Unheeding passing objects, however new and strange; inaccessible to curiosity and wonder, however little they know; incapable of any real merriment;—from mere absence of thought, seeming absorbed in deep cogitation,—they only awake from total apathy to give way to the most sudden and extreme irritation. They pass, without any ostensible reason, from the apparent gravity of the sage to the groundless laughter of the infant. They sometimes bestow on worthless trifles the admiration they withhold from real wonders. If they recognise a Providence it

is only in evil. For the performance of no deed, however kind, do they feel any obligation, or return any thanks. How should they? They cannot conceive a desire to oblige. They only fancy man to give away what he wants to get rid of, what he finds it a trouble to keep. But while no favour bestowed excites in them any gratitude, the least boon denied provokes their utmost wrath. Desiring no applause, they fear no disgrace. They know not the value of virtue, of truth, of honour, of renown. They thieve, they lie, they are faithless without remorse and without shame. They are unable to compass abstract ideas of number or of quantity. The least process of addition or subtraction exceeds their mental faculties. Their hardly articulate language only affords words for a few concrete ideas. In their wilds, which, however extensive, are hardly able to supply the restricted wants of a thin population, each new comer is looked upon as an intruder, and treated as an enemy. Each tribe, however small, regards each other tribe, however distant, with hostile eyes. Each tribe even regards its own members who no longer can contribute to the general defence, as no longer entitled to the general protection: as lapsed from their former privileges, as having become a mere encumbrance, as only fit to be spurned or be despatched. Between two different tribes, any meeting, avoided as long as possible, when no longer to be averted, becomes

a fight: not indeed in the open field and by fair warfare, but in ambush and by treachery. Prisoners are devoted to a lingering death; and the hardihood with which torture is endured, only proceeds from the hopelessness of inspiring pity. On their wives they never bestow the least endearment, on their offspring any correction. Their companions ill or wounded they leave behind. Their parents when old and infirm they drive away, to die deserted. A life of distrust and suspicion is early closed by a miserable death: for while the African black, like the spaniel, thrives in slavery, and fawns upon his tyrant, the copper-coloured American, like the hyæna, cannot be tamed or brook a master. The small number of those that still prowl about their wastes diminishes daily; and soon the vast continent of America will be entirely stripped of aboriginal races.

America, however, seems to have spontaneously produced races more finely organised than the Caraibs. To the south of the line, in the vicinity of Rio de Janeiro, are still seen those Indians of Tamoy, whose bow no European can bend; across the inland plains of Patagonia still roam those tribes that by their size make the tallest European look diminutive. Before America was remodified by the arts of Europe, it brought forth, from its native exuberance, large cities and flourishing empires. Of some

of these the European invaders accomplished the fall: of others the sun had again set even before these strangers appeared. Of such we find the remains on the borders of the Mississippi and in the province of Quito. It does not however appear that the sciences or even the arts ever attained among the Americans a very great degree of eminence. All the gold they possessed still left them destitute of coin, all the languages they spoke, of writing. They used for representing their thoughts none but symbolical signs. In their most civilized states government still remained an unmodified despotism; religion a senseless and sanguinary idolatry.

It is of Asia that the high central table-lands, the outskirts every way slanting down to the surrounding seas, and the far-spreading islands, seem to have produced the human races most different in their organization, most distant in their faculties of mind and body. Among these races, already very superior both physically and morally to those described as having arisen at its Austral Asian extremities, are the more central Mongul race. Still do its individuals yet preserve many marks of inferiority. Their enormous cheek-bones often give their flat faces a width exceeding their length. Their obtuse os frontis and shaggy eyebrows completely overshadow their small piercing eyes, of which the long close-drawn lids descend obliquely toward

their small depressed nose. Their organs of smell hardly rise to the level of their large and skinny lips, which extend the whole width of their ample and projecting jaw. Their enormous hemless ears stand out at right angles from their ill-formed head, while their small receding chin is only decked with a few coarse bristles. Their contracted brains do not prevent the thickness of their skull from giving a preposterous size to the circumference of that head, which the shortness of their neck keeps wedged close within their huge elevated shoulders. Their bulky body, ill supported by meagre and bandy legs, seems almost by nature itself so formed as to need the assistance of that equestrian life, which their native steppes so particularly favour. To the Tartars they owe their written language, to the Thibetans their creed; and however long they have had the physical peculiarities of their frame remodified by intermarriage with other surrounding races, less marked by the hand of nature, these peculiarities are so tenacious, that their descendants still retain the impress of the Mongul features.

The Chinese still display the same aberrations of form, but in a milder degree, and therefore are supposed to be descended from the Monguls: but why may they not spring from primitive parents distinct from those of the Monguls, which only from having arisen in a

soil and climate nearly similar, have thence alone derived an organization naturally very similar? If the Chinese, though resembling the Monguls, seem to excel these in mental faculties, the Japanese again, in their turn, seem equally to resemble, and yet in energy of mind far to surpass the Chinese.

I shall not pursue any further my examples of races, higher than those described, and yet in their qualities physical and moral short of the very highest races; like that of the Malays, the Indians, the Arabs and the Copts. All of these alike still prove their inferiority to the higher exemplars, by certain features either too long or too short, too full or too meagre, too protruding or too depressed, to preserve the exact middle line compatible with the highest degree of utility and of beauty. All of these alike, by complexion too uniformly light or too uniformly dark, seem to want in their countenances that variety and contrast of hue, which marks the most perfect mixture of the different elements that compose the human frame.

The races which by nature seem most gifted with these qualities seem to have arisen in those regions to the south-west of the Caspian and of Caucasus, where Xenophon still beheld pleasure-gardens similar to that of Eden, the first cradle of the first scriptural pair, and bearing like that the name of Paradise. They seem to have arisen in

those regions where, after the deluge of Noah had overwhelmed the surrounding land, the ark first touched ground on Mount Ararat; where rose near the Euxine that city, from the anchor found embedded high up in the neighbouring mountain, called Ancyra; where in later eras on the rocks of Samothrace still remained marks of the deluges of Ogyges and Deucalion; where alone the cereal plants, since diffused over a great part of the globe, first were by nature spontaneously produced; where arose the first great postdiluvian monarchies of Armenia, Persia, Assyria and Media; where originated the most ancient and wide-spreading language on record, that Pahli, the mother of the Sanscrit, the Greek and the German; where Babel's tower since passed for the central point whence diverged in different directions tongues wholly different; where first prevailed that earliest and simplest deviation from the pure worship of the Creator himself, which still had for its object his earliest and most general creations, ethereal fire and its first offspring the heavenly bodies; where to the last the kings of Media, of Persia and of Pontus still had the symbols of this fire worship displayed on their mitres and impressed on their monuments; whence through the regions of Colchis, round the northern shores, and through Pontus, round the southern coasts of the Euxine, seem to have travelled westward

those tribes which, settling further down on the opposite continents of Europe and of Asia, and in the intervening islands of the Archipelago, bore the earlier different appellations of Hellenes, of Pelasgi, and others, which at last were confounded in the more general denomination of Greeks; and became that of the people most eminently gifted of which records have survived the wrecks of time: where to this day specimens of the physical perfection of their first ancestors still are beheld in the population of Circassia, Armenia and Georgia, still reckoned the handsomest of the human race.

Those Greeks who in their own original nature must have found the models of those pre-eminent forms of which their art offered the imitation, and of which their degenerate descendants only present the partial remains, mixed with baser alloy, and defaced by subsequent corruption, must in their primitive state have possessed the highest organization of body and the highest capabilities of mind. They formed the races who in the shortest limits of time, and in the smallest circumference of space, with the least assistance from foreign example or tuition, made in art and in science the furthest strides in the most opposite directions: who in natural powers of body and of mind must most have excelled all other later nations which, with the benefit of their example and their precepts as guides, have

still only gone beyond them in those acquirements which mere time suffices to mature and perfect, and which to this day are forced to acknowledge their by-gone pre-eminence in whatever is the spontaneous offspring of innate genius and talent.

In the representations of the ancient Greeks we find the skull most rounded, the forehead most square, the brow most sharp, the nose most removed both from the aquiline and snubbed extremes, the lips most wavy, most curling up, most neatly hemmed, most luxuriantly pressing on each other; the chin most convex, the outline of the face most oval, most distant alike from uniform width and from unvaried elongation, the throat most developed in its forms and disengaged in its movements, the chest most ample, elevated and roomy, the waist of slenderest span, the extremities most taper, of any race. We find the skin represented as having its transparent white at its surface most marked by the purple meandering vein, at its extremities most blending with the rich crimson of the blood; the lips tinted with the richest coral hue; the long silken hair most neatly implanted, and most distinctly defined by its auburn or jetty hue; under eyebrows most arched, most confluent and most carefully penciled, and eyelashes casting underneath the softest and most vapoury shade, we find the eyes most full, most resplendent with a

lambent fire. We find a countenance most lofty, radiant and animated; a gait most elastic and firm; movements most easy, varied and replete both with vigour and with grace; and when from the contemplation of the qualities that strike the sense we pass to those only cognizable to the mind, we find symptoms of that mental aptitude to every pursuit of art and of science, the most varied and the most opposite, which, by its transcendency justified, over other nations, called barbarians, the pre-eminence universally allowed to the Greeks.

Still do even the Greeks themselves seem not entirely to have filled the full measure of perfection which, under the most favourable circumstances, appears by nature to have been allotted to the organization of man.

Every nation of antiquity, even unto the Greeks themselves, preserved some record of a nation still more highly gifted than itself, which once flourished on the earth, but was subsequently again, in one of those great revolutions which marked the infancy of the globe, swept away from its surface. The Greeks retraced its existence in those Titans afterwards subdued by their gods, and cast into the fiery furnaces of Etna; the Jews recorded its recollection in the rebel angels by Jehovah for their pride hurled into the flames of hell; in those giants, which on this globe are only once men-

tioned; and in those very descendants of Adam himself, whose longevity, like the size of the Titans, far exceeded the dimensions of later generations; and bespoke a vital energy, since greatly diminished in the postdiluvian races. The Medes and the Persians preserved similar memorials of races gone by, more perfect than any of those remaining, in their Peris, their Dives, their Gin, and their pre-adamite monarchs, also at last for their crimes cast in the regions of everlasting fire.

Even the Hindoo mythology retraced this primitive perfection of human beings in those powerful spirits which, arisen from earth and warring with the hosts of heaven, were at last swallowed up by the very parent from which they had sprung, and, in the deepest recesses of the globe, doomed to eternal flames.

Plato particularly describes as more beautiful in person and more transcendent in intellect than any of the nations remaining on the earth, those Atlantes who probably inhabited the vast inland basin since filled by the waves of the Mediterranean, along whose southern coast still soars Mount Atlas. Having in their pride forgotten that Deity to which they owed their excellence, and having only retained a superiority in vice, their day of final doom at last drew near. When the high waters, long pent up in the table-lands of Asia, whence rivers now

flow downwards to every point of the compass, broke their barriers, and in their descent westward successively formed the inferior reservoirs of Lake Aral, of the Caspian sea, the Euxine, the Archipelago, and that last aggregate of internal waters, shut out from the vast ocean by the Straits of Gibraltar, called by pre-eminence the Mediterranean, together with the intervening steppes and plains of salt, these Atlantes were at last, with their country, for ever swept away from the face of the earth.

CHAPTER XL.

After substances, before fluid and inorganic, had been combined together into bodies organized vegetable and animal, unto the highest, that of man, they again, on decombining and reissuing from these bodies, are separately recombined into other bodies organized vegetable or animal, later but less complex than the former.

We have seen that substances, first fluid and inorganic, are by degrees combined in bodies merely vegetable or also animal, unto those of the latest and highest species we know, those of the most exalted human beings; but as life consists of elements constantly from fluid combining into solids, and from solids again decombining into fluids, these elements which in one form are combined into living solids, may, on again dissolving and issuing from those solids, anew be, even while the collective life of the former individuals lasts, recombined in another form; and in proportion as more different elements have been combined in different organs and parts of the same single connected individual, of these different elements, from the different organs and parts of

that single individual again, whether in the healthy state of that individual, or when it becomes diseased, or again when dead it entirely decomposes, issuing, each may afresh with certain others from without be recombined into other individuals of later and lesser species, again different from itself, and from others partly composed of its other emanations—namely, the emanations issuing from vegetables into other vegetables and animals, and those issuing from animals into other animals and vegetables, partly composed of its prior elements, but again more subdivided among different lesser individuals; always supposing that these elements from within the former body issuing, are by new elements from the atmosphere without so met, resisted and prevented from evaporating, as with these to be recombined into those new organic entities; since, where such communication of the elements from within the body issuing, with such new elements from without remixing with these, does not and cannot take place, no such new creations ensue;—since an unimpeded communication with the atmosphere is indispensable to their arising.

Not only bodies organized but even bodies still inorganic produced by nature, may, on being again decombined and recombined with elements from without of different sorts, again be recombined into more complex organic bodies. The very air we inhale, the very water we drink,

when their different component elements by decomposition lose their balance, may with other elements be recombined into certain vegetable and animal forms of fungi and of aphides floating in air, and, as they grow more large and weighty, alighting on more solid substances and bodies. Wood decomposing may produce its dry rot, and flesh its maggots. Nay, even fluids and solids, compounded by human art—wine, beer, vinegar, cheese, parchment, leather and others, when again decomposing in free surrounding atmosphere, may produce some mould, mildew, maggot, or other sort of secondary vegetable or animal, not elsewhere found.

Thus arose a few years ago round London, on all the apple and pear trees, no doubt from a new remodification of its atmosphere, a new species of coccus, never seen before, which I believe had only a short existence. Thus out of mere dung, in certain situations fermenting, spring up edible mushrooms. Thence it is that, when a body vegetable or animal dies, and with it leaves to die the minor bodies, formed of different parts of its exsudations, which only lived on its life, there arise out of its remains other new fungi and new worms more hastily and copiously formed, which, as soon as the source of their subsistence from within is exhausted, also again in their turn fall, and add their component fluids to the stock of those that, returning to the general mass of the

earth, again become able to serve as materials for, and are imbodied in new productions, vegetable and animal, of a higher sort.

These secondary living entities, out of the emanations of former entities from within, remixed with new elements from without, composed, are called parasites. As primary entities, vegetable and animal, are themselves larger, richer and composed of materials and parts more different from each other, they enjoy the unenviable privilege of being able in their turn to produce, feed and support parasites more numerous and more varied.

These parasites, from their commencement only able in part to subsist on the superfluities of their supporters, may grow till they rob these supporters even of their necessaries; till they rise on their ruin, and till their thriving produces the exhaustion, decay and death of the very foundation on which they rose.

There is not a mould or mildew so insignificant, a zoophite or polypus so mean, that is not able to give birth to some parasite still less than itself; that may not in its turn become the soil, the parent, the supporter of some fungus or animalcule, of which thousands may crowd on its surface. Of each vegetable larger, more important, and composed of substances and parts more varied, each sap and each organ, the cotyledon, the roots, the branches, the core and the

bark, the foliage, the flower and the fruit—of each animal more extensive and combined of elements more diversified, the egg, the parts and organs lymphatic and chylous, the blood veinous and arterial, the forms internal and external, the bowels and the skin, the organs vital, sensitive and intellectual, unto the very brain,—have each their parasites, some remaining for life immured in the parts in which they first were formed, others by degrees working their way out of these, and at last appearing undaunted in the broad face of day. Some are so small that to them a drop of lymph or blood is an ocean, that they swim in shoals through every duct and channel; and all naturally partake so much of the nature of the elements of which they are formed, that the very vermin born and bred on the body of a negro differs from the parasite that infests the person of a white man, who takes not care to wipe off his exsudations before these are, with new elements from without, combined into new living entities.

Nay the very parasites, vegetable or animal, of higher vegetables and animals, may in their turn again become the soil and cradle of other lesser parasites, vegetable and animal, to whom the former are what the oak is to the mildew, or the elephant to the flea. Of these some are so small, so imperceptible, that their very minuteness protects them from our grasp; that we may

all our lives be compelled to feed, to support, to shelter, to carry them about on our bodies, without so much as being able to brush off, or even to recognize the population of which we are the parents.

Life thus, as long as it continues to be limited to this globe, to its atmosphere and to its soil, may only seem to move in a constant circle, from its most inferior commencement rising to its higher modifications, and from these again reverting to the lower ones. It is only when it breaks through the magic circle, when its elements burst athwart the spell that surrounds them, when they soar to higher regions, that in these regions they find room for combinations more extensive and more lasting.

CHAPTER XLI.

Reasons why the words of Scripture should be taken more literally than they generally are, when it says that the first man arose out of the dust of the earth.

I HAVE thus far only given a sketch of the first creation and further development of such entities organic and living, vegetable and animal, from the lowest to the highest, as, however much they might in their turn again procreate later entities of the same species, did not themselves first arise out of earlier ones of the species; as were all still only primary individuals of their species. I have, however, described these entities as in their whole only arising out of prior elements, animal, vegetable and mineral already collected on the surface and floating in the atmosphere of this globe; and not as arising, in the way people in general seem to believe the thing to have happened, out of nothing material previously existing, and by mere miracle.

This belief I entertain, not in consequence of any reluctance I feel to the other contrary opinion of their having arisen out of nothing material previously existing, as holding out an event

in itself too wonderful to credit. It is equally wonderful that prior inorganized matter should have received from God the capability of being formed into the first organized bodies, as that such bodies should have been formed directly out of nothing prior; but the former is a wonder less disconnected with, less detached from, less in opposition to, more in unison with, more directly and naturally proceeding out of all the other former wonders of the creation, and more in its turn leading to all the other later wonders of that creation, than the latter: it is even more conformable to the words of Scripture itself, where it expressly says that man was created, not out of nothing material and cognizable prior to himself, but out of the dust of the earth; which can only mean the elements afforded by this earth, and by its surrounding atmosphere, before these were reduced to a state of combination, organization and life.

The time is in fact gone by for maintaining with Bonnet, and other naturalists of the last century, that all that has life can only proceed out of what lived before, till we ascend to the first living individuals of each species; and that these could only have been produced out of nothing prior that was not living,—could only have been produced by mere miracle.

Do we not even to this day, in the last and highest of organized and living entities, in man,

see new forms, organs and faculties of mind, not existing before, arise and be developed in his body, in his vital parts, out of the combination of elements taken in from without, which before had all only hovered in air or lain on earth, in an uncombined and unappropriated state? If we have shown that all the faculties of the mind, as well as those of the sense, and those of mere insentient vitality, must be founded on peculiar material organs, and that all material organs must be combined out of elements, before in an uncombined and unappropriated state floating around, it cannot be denied that only out of elements from without, first uncombined and unappropriate, these organs can be subsequently composed.

Do we not in the same way to this day see the mere organs of vitality, on which those of sense and intellect must afterwards be founded, every where by new elements from without, before uncombined and unappropriated, in their turn formed and developed?

And if, while in man, and in the higher brutes and higher vegetables, we only every day see the later increase and development of the first organs, derived from elements taken in from without in an uncombined and unappropriated state—if in these entities we do not see, out of elements from without driven together, the first foundation, formation, combination and appropriation into such organs, of entities organic and living less important—of lychens and of worms—of

mollusca and of zoophites—may we not in a manner see the very first commencement and formation, arising out of the meeting and combination of opposite elements from without, before uncombined and lifeless, which from surrounding air and water are supplied?

Do we not in every region, where no prior germs of any living and organized entities could have previously existed, or whither none such could have been conveyed from elsewhere—which, for instance, has just for the first time emerged from the bosom of the sea, at an incalculable distance from any surrounding land, whence the germs of such entities could have been wafted to it,—by degrees in the exact proportions suited to their later development become covered with all the lower species of vegetables and of animals, to which its aspect, its climate, its situation and its soil—the peculiar elements aërial and terrestrial fitted to compose and support such entities—rendered it suitable? and these precisely at every place and at every time, of the sorts and in the proportions, in which its peculiar elements render it capable to produce such; without leaving the possibility of rationally believing that the germs of these entities have been brought, ready formed, from other regions?

Nay, do we not in their turn see those primary organized entities, thus out of nothing organized before, but out of mere inorganic elements combined, in their turn, while healthy,

from their own emanations, recombined with new elements from air and earth without, produce within their body and at their surface parasites, vegetable and animal, even more still than themselves soaring beyond all suspicion of having had their germs, ready formed, brought from elsewhere?

Do we not see when of a region or site, the elements, the atmosphere, the climate, the soil or the situation undergo a change—when they afford elements different from those they afforded before, this region, this site, without any interference of man or beast, again change the nature of its indigenous productions, vegetable or animal? and when the interference of man or beast again changes the thus far inorganic and inappropriated elements of the soil, do we not again see other new species, organic and living, vegetable and animal, of which no preformed germs have been from elsewhere there deposited, arise at the exact time, in the exact place, and in the exact proportion in which these causes would spontaneously have produced these effects?

Do we not already see when mere inorganic substances become disturbed, when air is decomposed by a blight, when water is left to stagnate and to become putrid, new recombinations produce new entities organic, vegetable and animal—new mildews, new aphides unheard of before?

Do we not in the same way see vegetables

and animals, when they become diseased—when they exsude saps different from those which they exsuded in health—by the recombination of these new substances from within with new elements from without, produce new sorts of entities, vegetable and animal, different from those they produced while in health? Do we not in the same way again see when vegetables and animals entirely die—when all their component parts alike decombine, out of the decombination of these arise new entities, new fungi and new worms, of which no trace was discoverable in them while alive, provided only on decombining they have communication with air, and recombine these effluvia with elements from that air?

Do we not see even vegetables and animals arise, which having no forms, no faculties of procreation, and thus, not arising out of earlier entities of the same sort, can only to the present day in their whole arise out of prior inorganic matter; unless indeed the miracle of their arising out of nothing prior be every day every where repeated and renewed?

And can we thus, without entirely departing from all the rules of belief and credibility, refuse believing that at least certain entities organized, living and sentient, can at least have their combinations produced out of elements before inorganic, uncombined and lifeless?

Nay, can we draw a line? can we refuse to believe that all entities organic and living with-

out exception, even the highest, man himself, may not, must not, have arisen in this way, at first, and while by the non-appropriation of any elements into prior human beings these elements still remained in the greatest abundance and closeness, ready to be thus united; rather than that by miracle they should have arisen out of nothing previously existing, when those elements themselves in their turn still remained thus far uncombined, and where only at a later period taken in and appropriated by those human beings?

Can we suppose that it was not, on the contrary, in consequence of these unappropriated elements every where, as soon as they arose in sufficient quantities, sufficiently near to be combined together, being so immediately combined into the entities to which they were suited, as afterwards only to leave these entities already combined, themselves able through the medium of their own reaction from a further distance to attract the elements unappropriated more rare that still remained, or that were through the decombination of former ones again reproduced, and re-emitted in circulation, that, where a certain quantity of these elements had already been spontaneously combined, directly out of more inappropriate elements, later ones of the sort were only permitted to be combined through the medium of the more powerful attraction of these former ones already combined?

That thus, in regions already peopled by the higher entities, who require for their first formation materials more varied and more copious, there is no chance of such fresh combination taking place by mere chance out of the approximation of the necessary elements, without the intervention of prior individuals of the sort.

And that only in regions newly emerged from the sea, and where spontaneous combinations cannot yet have any witnesses able to vouch for the fact, such can still take place.

Having thus shown how out of elements before on earth and in the atmosphere floating, unappropriated and uncombined, must spontaneously have arisen and been combined the primary individuals of each species organic and living, vegetable and animal, from the lowest moss to the highest man that arose on this globe, I shall now proceed to show how, out of these primary individuals of each species themselves, and through their medium, could be made to arise later ones of the same sort in the way of regular procreation.

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ESSAY

ON

THE ORIGIN AND PROSPECTS

OF

MAN.

BY THOMAS HOPE.

IN THREE VOLUMES.

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ESSAY

ON THE

ORIGIN AND PROSPECTS OF MAN.

CHAPTER I.

In most entities organised and living vegetable and animal, of the opposite elements and fluids, the one sort aerial and coming from above, and the other sort aqueous and coming from underneath, of whose meeting, combination and consolidation these entities are formed and increased, after a time a portion no longer in the individual solid parts of these entities already formed finds room so to continue meeting as with these former parts to combine in further additions to their individual extent. This portion then within these former parts finds room to meet only in the first nucleus of new individuals, detached from the former individual, and only similar to the same, which are called its offspring, and of which the former individual is called the parent.

It is ridiculous to say, as people sometimes do, that organised and living beings, vegetable

and animal, only fulfil the end and purpose of their existence in this world, when they procreate. This is saying that in their individual existence they have no end, no purpose: that those who cannot procreate can have no purpose to fulfil; that those who can procreate, have no purpose to fulfil till they do; and that thus the only purpose of the individual is to continue and extend the species: to raise those other individuals only destined to push him off his stool and replace him, without the species itself by its existence achieving any good, effecting any purpose.

But it is true, to say, that since individual existence is at best on this globe only very limited in its extent and duration; and since that of each species itself must remain less extended, less durable, and less multiplied without procreation, procreation is the means of giving whatever purposes arise from individual existence greater extent, duration, and multiplicity.

On treating this subject it will appear, that as only on this globe in individuals, vegetable and animal, of species composed of few different sorts of component elements, there remains room for these individuals to be extended to an indefinite duration and size, and as in other individuals, vegetable and animal, of species composed of elements more complex and varied, there is not room for such indefinite extension and duration, in these latter sort of entities, it is only through

procreation in them of other individuals of the same species later than, and distinct from themselves, that by means of these later individuals the species can, through many successive individuals, be connectedly continued.

In certain of the lower entities, organic and living, such as certain lichens and zoophytes, of the meeting and combination of elements aerial and elements aqueous, each still in small variety, composed, these elements are still only combined in solids situated so far asunder, as to leave room for the later new elements of the same sort that flow in, to meet and to combine with the former ones already combined, as well as with each other, or at least, where they leave not their new influxes room to be, with the former ones already combined, again recombined in indefinite continuation, to suffer them again to drive these former out and to replace them, so as to enable the entities to offer indefinite extension, or at any rate, indefinite duration, without any elements being in them both prevented from being connected with themselves, and also prevented from being in their uncombined state again emanated from them.

But where opposite elements aerial and aqueous, each more varied and complex, meet and combine in entities organised and living vegetable or animal more dense in their combination, after a time of their opposite inflowing elements a

portion no longer finds room either every where to meet and to combine in new parts, and to consolidate with the parts already consolidated, so as to produce their further individual extension and growth, nor yet to be left to circulate unimpeded through these parts, till again permitted in their uncombined state to flow out. In these individuals, these influxes of opposite sorts and from opposite quarters, wherever in their body they meet, without on the one hand recombining with the solids already existing in that individual, and by new solid parts again connected with its former solid parts increasing its individual growth and extent, and at the same time, without, on the other hand, being by the pressure of these former solid parts again immediately wholly driven out of them, are only by the pressure of these former parts within them combined together in the nuclei of new individuals, separate from the former individual, and only resembling the same, which in this former individual are made like itself to grow and develope, till, no longer finding room in their receptacle to extend and develope any further, they are at last, by the increasing pressure of the same driven out, and then made, by fresh influxes, no longer through the medium of the former individual but directly received from without, to complete their existence entirely separate from the former individual, whose off-

spring they are called, and who is called their parent.

Those entities organized and living, vegetable and animal, in which in different parts of the body are formed such nuclei, which, after a certain period of development are from their interior pushed out, and made to appear at different parts of the surface, and thence, are made to detach themselves, to drop off and to commence a separate existence, are called gemmiparous: and such are among vegetables ferns, and fig plants, which immediately from the leaves or trunk, without any intermediate blossoms or sexual parts, push forth complete nuclei or seeds, capable, on detaching themselves from the parent, of expanding in new individuals like them: and such among animals are those polypi, which, after a certain time from different parts of the parent body peep forth, and grow into young polypi, that detach themselves from that parent.

Nay, we may consider as such the tenia springing forth in the bowels of man, which from its extremities puts forth new tenias that like the pine apple among plants, without detaching themselves from the parent, find room enough to expand and attain their full growth, and by in their turn procreating in the same way, produce a connected chain of animals, lengthening by degrees.

In entities of an organic and living sort, vege-

table and animal, in which, of the elements of an aerial sort which I shall now begin to call male, as being those in which originate the male sexual parts, and of the elements of an aqueous sort, which I shall now begin to call female, as being those in which originate the female sexual parts, each separately already are in too great variety to find room immediately to combine with the other in the inside of the parent entity, in the nuclei of new individuals, singly already having the whole of the elements or fluids of the parent, each first only combines separately in one of the two opposite halves of those elements: of the male elements, coming from on high and aerial, the part not finding room to combine in new additions to former parts of the same sort in the parent, first only in the parent body combine and consolidate separately in new intervening solid parts, different from those of the parent, called expressly male; and of the female elements, coming from underneath and aqueous, the part not finding room to combine in new additions to former parts of the same sort in the parent, first, only in the parent body combine and consolidate separately in new intervening solid parts, different alike from those of the parent, and from those of the male parts, called expressly female. In vegetables, the former new parts are more particularly called blossoms and the latter new parts seeds: in animals, the former

new parts are more particularly called spermatic ducts, and the latter ova; and in both the new sets of organs are collectively called sexual.

I say, that in individuals of certain species, vegetable and animal, the incoming saps aerial and aqueous—male and female—not only find not all room to combine in fresh solid parts, accruing to the former individual solid parts, and to make these former solid parts receive further growth, but find not even all room, within the same parts of the parent individual, directly to combine in all the parts of a new individual, or offspring like that parent. Only in one place the male saps, and only in another and different place the female saps, each separately find room first to combine and consolidate in a different half of the whole mass of organs, necessary to form the full complement of elements of a new individual like the parent; and each leave the other half to be combined and consolidated in another place, different and distinct from theirs; so that, after the two different and opposite halves of these elements have each been somewhere separately combined, they still require to have elsewhere their effluxes united in one single embryo, in order to be able to perpetuate the species: and these are the causes of the distinction of sexes, and of all the subsequent contrivances for the reunion of the different efflux from the organs of each, existing in the individuals of certain species, vegetable and animal.

In different species, particularly of the vegetable sort, in the first solid organs both male and female thus from the fluids aerial and aqueous separately formed, these fluids meet in their way to the opposite fluids with later obstructions less or more multifarious, at each of which they revert backwards to the extremity whence they came, and recombine with the elements from without coming from that same side, in new proportions, which make them consolidate in new forms, and thus compose on the one side blossoms, and on the other side seeds, in their component parts less or more complex, diversified and often beautiful, before by the union of their opposite fluids, the male parts fertilize the seeds of the female parts, and render them capable of further developments, like those of the first embryo or nucleus of the parent.

But at last, the parts male and female, encountering from without no further obstructions, are made from within to elongate and protrude outward, the male parts in a glandular organ called in vegetables anther, and the female parts in a tracheal organ in vegetables called vulva, or pistil; and when, by further effluxes from the parent body, in these sexual parts are poured more elements than their formation can consume, and their capacity can hold, the insensible emanations of these elements grow externally in different parts of the body, in the shape of vegetable down, or animal hair, or horns, or beard, or

feathers, and even in the males of certain insects, such as the ant and glow-worm, in that of wings, which the female has not, and which serve that male to approach the latter, signs of what is called puberty: and which begin to make a considerable difference in the outward appearance of the proud cock and humble hen, the noble stag and meek doe, and the shaggy lion and sleek lioness.

The more sensible and copious local effluxes of these superfluous elements from the male parts of vegetables are called pollen, and from the male parts of animals are called sperm.

Of the elements and fluids more aerial emitted by the male, and more aqueous exsuded by the female parts, the reunion and remixture, however, is necessary to complete the whole of the elements male and female, or aerial and aqueous, similar to those in which began the parent individual, and which are again necessary to begin the complete germ or nucleus of new individuals similar to that parent.

In some species vegetable and animal, the parts sexual both male and female, though the elements and fluids that form each begin in the same individual to flow from opposite quarters very distant, still are in the same individual brought and developed so very near each other, that while they already remain distinct and separate, the male parts originating from on high

and the female parts originating from underneath, they yet, as it were, embrace and interlace with and pierce each other, and together form a single body; so that when the time comes for the male parts to eject their pollen, this prolific juice can easily flow into the female parts, at the same time expanding and thirsting to receive it in their calyx, and there remix it with their own outflowings in the full complement of substances fit to begin the nucleus of a progeny like the parent.

According as the fluids male from above are, by the pressure of those female from underneath, in their career through the vegetable stopped higher up or lower down, the blossom, formed of the junction of the sexual parts male and female, is made to peep forth and to show itself externally higher up or lower down in the plant. In the stapelia, it appears immediately above the roots, in the lower part of the stem: in the cactus, it may be traced through the whole body of the leaves unto their utmost tip, before it there expands. And these instances may have their analogies in certain zoophytes or polypi not yet investigated.

In other species, vegetable and animal, the parts sexual male and female, finding obstacles to their union greater and more insurmountable, each are singly completed at a distance less or greater from the other, and are only later contrived

to make the superfluities of the elements that formed each separately, meet in the nuclei of new individuals like the parent. Such are among vegetables the horse chestnut, in whom the fluids male and female still each only forms separate blossoms on the same branch or spike: such are the maize and the banana, in which the parts male are made to expand near the top, and the parts female near the bottom of the plant: such, in fine, seem to be some minor species of animals, in which the parts sexual male and female may be traced in the same individual, distinct from each other. So peculiar, however, often is in these animals the relative situation of these opposite parts, that the parts male cannot pour their prolific fluid in the parts female of the same individual, and that each individual wants another individual with whom in turns to act the part either of male or female.

Thus far, however, vegetables and animals, still showing their parts sexual male and female completed in the same individual, still are called androgynous.

But in some species, both vegetable and animal, in which the elements of each different sort of fluids, both the male and the female, are again more copious and varied, the same individual finds not room after its own proper parts are completed, to complete or even to begin the separate parts sexual both male and

female, destined to complete other individuals like itself, to drive these parts out, and to make them both expand as appendages to the same single parent individual. In these species, in each separate individual, which ever of the two opposite fluids, male or female, first gets the preponderance over the other, stints that other of the room necessary for forming its separate solids, or at least for bringing these solids to complete development and maturity, crushes them in the bud, and again absorbs and takes to itself all their decombined elements. In these species, each separate individual, itself composed of the meeting, mixture and combination of elements both aerial and aqueous, both male and female, cannot find room in its single body, of each sort of elements to supply a sufficient additional superfluous quantity, even for the separate formation and completion both of the parts male and parts female, each able to exsude enough of the different elements of which they were composed, to remix with a part of those exsuded by the other, into the nuclei of complete new germs like those of the parent. In these species, each individual, after a certain period of individual development, and when it begins out of its superfluities to form sexual parts, only finds room to form or finish one sort of sexual part, either that male or that female, exclusively, and leaves to some other different and distinct individual the task of forming or finish-

ing the other sort of sexual part, of which the exsudations must be remixed with those of the former, in order to complete the germ of an offspring having all the parts, common to both parents.

In these species, each individual, itself first beginning to be formed out of the mixture of elements both aerial and aqueous, both male and female, and thus in its own individual, still androgynous, after a time becomes in regard to the parts destined for procreation, exclusively male only or female only; and the species becomes divided in males and females distinct and separate from each other, whose issue must be remixed before through their medium can out of them be made to arise new entities of the same sort, distinct from themselves.

Of all these circumstances, small as were the advances of the ancient Greeks in physiology, Plato seems already, whether through the force of his own genius, or more probably, thanks to the early eastern philosophers whom he does not quote, to have obtained a glimpse, where he asserts that in an anterior state of existence more perfect, of which he only paints our present condition as a later corruption, man was not only immortal but androgynous, and consequently not only exempt from the distinction, disparity, discord and strife, which now arise between young and old, parent and offspring, the sage

and the unexperienced, but free from the dependance and contentions which have among their later posterity been by these distinctions entailed upon man and woman, husband and wife.

It is certain that on this sublunary globe, only from its divers materials not finding room, at all times and in all places, to mix in equal proportions, proceed, not only the combinations of some portions of its different elements in species inorganic and organic, vegetable and animal, different from and inferior to other species, which remain wholly distinct and separate from these other species, but, in each of the organic and living species, the distinction of individuals, simultaneous and successive, distinct from each other, and the necessity of some of these falling to make way for, and give room to others to rise in their place; and even in the higher organic and living species and individuals, instead of the union of each sort of element into a single central organ more perfect and more powerful, and consequently the blending of all the organs, here separate and distinct, that separation by which the organs which arise first, by their resistance and obstruction, force the elements of other organs vital, sensitive, intellectual and reactive, formed later than themselves, to become split and divided in two distinct halves of the same current, or in two currents opposite each other, forming organs of sight, of thought

and of action, eyes, ears, lobes of the ganglia and brains, arms, legs, &c., in halves, in pairs, in doubles; and thus, by being more divided, rendered less powerful and less efficacious.

It is certain that this same want of room, instead of allowing each part of each individual to receive from new external influxes those constant additions, which must render its single extension and duration indefinite, prevents each after a time from further influxes to receive to its own individual new increments which would render it immortal, but obliges these further influxes only in the parent to form nuclei of new individuals separate from that parent, which only acquiring in the parent body a certain degree of development, are at last by its want of farther room to retain them driven out, and made to commence an existence wholly separate, before they find space to complete their individual development.

It is certain even that in the organic entities, formed of the meeting and combination of elements, partly coming from on high and called male, and partly coming from underneath and called female, each more varied and complex, of the opposite elements which by their combination have brought their own individuals to completion, only one half finding in each individual room to begin the nuclei or germs of new individuals like the parent, and forcing the other half only to be formed in another individual,

from which the former has been excluded, into the other half of that nucleus or germ, is the cause, first of their arising parts male and female distinct and separate from each other, and next, of the distinct and separate issue of each of these parts again requiring to be again joined and mixed, in order to complete the nucleus and germ of new individuals like the parent.

And it therefore is probable that in a world, a globe, more perfect, more ample, more central than the present, in which every one of its component elements will every where find room to mix with every one of its other different and opposite component elements in more equal proportions, not only these elements will be recombined in such a way as to remove all distinction of inferior and of superior species; but, in the single exalted species remaining, will remove all distinction of different individuals simultaneous and successive, each only individually limited to a short period of extension and of duration, each forced to make way for other individuals distinct from itself, standing beside or coming after it; and most of all, in that single remaining individual will remove the super-added difference of a male and female sex separate and distinct from each other.

Indeed this supposition, this expectation, our Saviour seems to confirm when he says, that in a higher and more perfect future state man will no longer be subject not only to death but to marriage, to giving in marriage; and thereby seems to

imply that there no longer will be any distinction of sexes, nor any mutual dependance arising from that division; no necessity for a reunion in order to continue the race; none of the strife and discord resulting from that partial reunion while it lasts; none of the loss and grief which must nevertheless arise from its being again some time or other dissolved; and none of the other drawbacks upon the felicity of our present existence, proceeding from its being parcelled out among lesser individuals, each limited in time and space.

Let us see how in organic entities, vegetable and animal, the elements and fluids, male and female, by the orgasm which their superabundance causes in their separate receptacles, forced out of these, made to overflow them and to expand in outer space, are again made to join, and to complete the nuclei of new individuals like the parents.

In most vegetables, where, by the separation and distance of the males and females, the pollen ejected by the male cannot immediately drop into the calyx of the female and fertilise her offspring or seed, the breeze is entrusted with the task of conveying that pollen to its receptacle; though it often fails of fulfilling its office, when the distance is great.

In the valisneria, an aquatic plant of which the male flowers, while immature, remain by their stalks confined to the bottom of the waters, that maturation which renders the pollen ready for

explosion, pushes the flower from its stalk, makes it rise, liberated from its shackles, to the surface of the wave, and there causes it to float among the female blossoms, ready and thirsting to receive its fertilising pollen.

In animals endowed with sensation, the scent, the effluvia of the female elements attract the male. In fishes, however, in which that scent, while those elements remained imprisoned in the female womb, could scarce be sufficiently powerful and diffusive to attract the male, the female is, by the maturation of her fluid, made to emanate this latter in the shape of eggs, without the co-operation of the male, who never approaches her person, but only fertilises her offspring after it has been pressed out of the womb, and then spreads over it the elements wanted for further completion and development. Some species of domestic birds, that are by man made to feed copiously, fare the same. They drop their ova before these are by male fertilised: but in these, after being thus dropped, the opportunity for performing that act no longer exists.

In frogs, toads, and some other amphibia, the male seems himself, by the very same voluntary act, to press the ova out of the female body, and to fertilise them on their passage into open air.

In other animals the male fertilises the ova of the female in her very womb.

After the fluids male and female are thus reunited and enabled to complete the nuclei of

new individuals similar to the parents, in the very body of the female, they are left, in some species, to receive in the womb a development less or greater than in others, before they be, for want of further room, from that womb expelled, and made to finish their further development in unconfined space.

In many plants and animals the mixed and fertilised elements are in a still liquid state, and in the shape of seeds or ova, already emitted, and of these entities the parents are called oviparous. Of many genera, vegetable and animal, the offspring are only out of the maternal womb by greater influx of air made to acquire even their first, as well as all their later, different solid forms. Such are most vegetables, and such are many insects. These latter first only issue from the egg as a worm, and only by degrees, in outer space, become, first still seemingly torpid chrysalides, and at last lively flies. The same is the case with the offspring of the frog, which first from the egg issues in the pool a mere round tadpole with a long tail: is afterwards, by new obstructions arising to the flow of its plastic fluids, made to feabsorb that tail, and to shoot forth anteriorly a head, and sidewise four legs, with which it leaps on land, and skips away a frog. In human beings the tail is reabsorbed in the very uterus, in which man already receives his last forms, though not his last proportions.

Some plants, such as the nymphæa nelumbo, and many species of animals, are retained in the parent womb not only till they are consolidated, but till they develope in solid forms more or less complete, before they are permitted to commence a separate existence; and the parents of these are called viviparous.

Of viviparous entities some still issue their young in an early state, and before they have acquired their last solid form; others, like the pipa-toad and the kangaroo, after having sent their offspring forth, still offer it an occasional shelter within the very integuments of the parent, till more inured to the contact of external elements; others, when they once have dismissed their young from the parent mansion, never recal them within its shelter.

No individuals of any organic sort, vegetable or animal, since they can only be formed of the union of certain elements aerial and male, with certain elements aqueous and female, can, on their first formation in the shape of a seed or ovum, yet have any signs of a separate sex, either male only or female only. Out of the later separation of certain portion of the fluids aerial and male, from certain portion of the fluids aqueous and female, both superfluous to the formation and support of those parent individuals, and which go to the formation of new individuals of the species, and out of the predominance of one of these superfluous fluids over the other, can

this separation and distinctness of the two opposite sexes in an individual, be later produced. But this separation, and all the other events that ensue and that produce a reunion of part of the elements separated, may in different species, vegetable and animal, take place at very different periods.

In some plants and animals a single season sees the parent seed or ovum develope not only in all the essential parts of the individual, but in all those other parts necessary to the procreation out of the same of new individuals of the species; and even sees the parent individual, exhausted by the exertion, fall and die, while the offspring rises and flourishes. Plants of this sort are called annuals.

Other plants and many animals require many years of growth and development, before their individual parts are reduced to that state of repletion in which, of the elements taken in by them, a part, again obstructed, is again turned off and made to contribute to the formation of new individuals.

The aloe lives many years in a state of sterility before, by one great effort, it collects the elements necessary for a fructification, which is usually followed by the death of the parent.

Some vegetables die after a single act of generation; others, that have once begun, go on, year after year, repeating the production of fresh blossoms and fresh seeds.

In most vegetables, which have endless repetitions of similar individual parts distinct from each other, each of these parts also produces, after a time, endless repetitions of sexual parts distinct from each other. A cherry tree is at one season white with blossom, at another season crimson with fruit. The ananas, commonly called pine-apple, from its resemblance to the cone of the pine tree, on the contrary, from its centre only puts forth a single mass of blossom and of seed. Like this vegetable, most animals who have their individual organs each collected in a single focus, separate and distinct from that of other organs, also have the parts of generation arising out of these, all driven to a single extremity, and there concentrated in a single body.

While all vegetables and a few of the inferior brutes not only issue from the seed or egg, but arrive at a large size, and attain a considerable age, before they are made, by the obstructions certain of their fluids meet with in attempting ineffectual additions to the forms of the parent individual, to show any signs of a distinct sex, either male or female, in the higher brutes and in human beings it fares otherwise. Formed of elements more diversified, in them, consequently, sooner commences that want of room for the fresh influxes to be added to the parent stock, which forces part of these fresh influxes to be diverted to the formation of new parts distinct from the former. The rudiments of distinct

genitals, male or female, already in these higher brutes and in human beings are visible long before they issue from the womb, and many years before these parts are brought to the maturity requisite for use.

Some animals that first vent their offspring in the shape of ova, leave to the sun the care of consolidating their fluid elements, and to the inanimate earth that of supplying them, when hatched, with fresh solid sustenance. Some oviparous animals, after hatching their eggs, are made to feel a false appetite, which makes them seek food, but again throw it up half digested; when their offspring, still weak and helpless in the nest, take in with avidity what the parent has rejected, and thus find a nourishment more triturated and easy to digest, till the period arrives when the parent, having regained her strength, no longer is obliged to disgorge her food, and the offspring no longer is obliged to content itself with the leavings of the parent.

In species that issue their offspring in a later solid form, the parent, of that milk, of part of which it first formed the young within her, retains enough, diverted to another channel, that of the mammæ, to find a relief and to supply the wants of her offspring, by feeding it from that source, until sufficiently strong to digest food more crude, drawn directly from without.

CHAPTER II.

Confirmation of the foregoing statements.

THAT in organic entities, vegetable and animal, the influx of fresh elements aerial and aqueous from without, which by their union with the former solids of each individual produce its own fresh growth and extension, when by the increasing density of its solids prevented from combining with these former solids, and only permitted within the same to combine with each other, produce within them the nuclei or germs of new individuals of the same sort with the parents, but distinct and separate from those parent individuals, which, after a certain period of further development and growth within them are driven out of the parent body, and made to commence an entirely separate existence, appears, since the offspring of each individual is always composed of the same species of opposite elements, aerial and aqueous, as the parent or parents, but separated from the component elements of the parent: since, where, by making individuals capons, the elements which divested from the individual would in the same have formed new individuals of the sort is prevented,

the former individuals become, by more of these elements remaining appropriated to themselves, larger and more long-lived; and where, on the contrary, in individuals by their passions this efflux is hastened and rendered too early or copious, they have their growth stopped prematurely, and remain deficient in size and vigour; since, in female bees, in which, when fed with poorer food, the genitals do not expand and develope, when fed with richer honey, the genitals developing render them what are called queens; and since all animals according as more copiously nourished, acquire procreative powers more ample.

That the aqueous elements rising from the earth underneath produce the female fluid and the seed, and that the aerial elements descending from on high produce the blossom, and the parts which fertilise the contents of that seed, is seen in the solanum tuberosum, or potato plant, in which too much water retained in the roots, and there producing potatoes, only leaves the flowers formed of aerial descending elements sterile and deficient in prolific seed; and since, on the contrary, the aerial elements from on high mixing in too great quantities with the aqueous elements from underneath, and with these producing too much prolific seed, leaves the plant deficient in succulent potatoes; and since, in an ungenial climate, where the aerial elements from above are not, with regard to the aqueous elements

from underneath, in sufficient quantities to complete certain fruits, the external integuments of flowers and seeds are often formed, but are left mere husks, unfilled with the vivifying principle of reproduction.

That where in each individual of a sort only one sex is left to appear, it is only because the preponderance of its peculiar elements has early in the formation of the sexual parts obstructed, stifled, suppressed, and absorbed the opposite elements which would have formed the opposite sexual parts, appears since, where that preponderance is not sufficient to render one sex perfect, and leaves its parts incomplete, rudiments of the other sex are left to acquire a certain expansion and development; so that entities in which in general only one sex appears, but in a perfect state, when by accident they unite both, have each only imperfect.

That in an animal in whom to parts merely vital are moreover added parts sensitive and intellectual, of these latter, the superfluities equally flow to the genitals, and in these mix with the superfluities of the more fundamental fluids, appears, since the offspring inherits not only the organs and faculties vital, but also sensitive and intellectual, of the parent.

That behind the brain the cerebellum is the organ through the medium of which this brain reacts on, and completes the sensitive and intellectual fluids, in the genitals appears, since the

cerebellum is first formed after and out of the superfluities and outflowings of the brain, and at the period of puberty expands more in proportion than the brain itself; and since castration, performed young, stops the growth of the cerebellum, by stopping the drain upon and afflux from the brain through its medium, which causes the difference in size and in form of the head of the ox from that of the bull; and since people, wounded in the nape of the neck, often in the testicles shrink and lose their prolific powers; and since mental desire of sexual enjoyment causes from the brain through the cerebellum and the sympathetic nerves the blood to be propelled to the genitals, to mix in receptacles, and to drive out of them the seminal fluid; and since, in youths who with strong sexual desires have inadequate powers of gratifying these desires, the cerebellum is found much developed, and the genitals very little, whereas, on the contrary, in those who with great sexual powers have feeble sexual desires, the reverse is the case; and since, in the canine species, in which the sexual inclinations have their periodical ebb and flow, the cerebellum keeps in its swell and depression pace with these tides underneath; and since, excessive venery causes languor and debility, not only in the genitals, but in the brain, cerebellum, and parts of the spinal marrow which connect the cerebellum with the genitals.

That not only of the parts vital, but sensitive, intellectual, and reactive, which are common to both parents, both parents supply a part to the genitals, but that sometimes the part supplied by the male, and sometimes the part supplied by the female preponderates, appears since sometimes the offspring resemble the one and sometimes the other more palpably.

That in females, the superior swell of the mammæ, and their afterwards filling with milk, and pouring out that nutritious fluid, arises from the greater abundance in them of the aqueous sap or chyle, and from the residue of that chyle, after contributing to the formation of the offspring, being made, as soon as that offspring is driven out of the womb, for want of drain downward to flow upwards to those mammæ, appears since, in males, formed of more aerial elements than females, and thus seldomer receiving a superabundance of chyle, the mammæ seldom swell and fill with milk, in its pure uncombined state.

CHAPTER III.

Progress which, from their first formation and birth forward, animals successively experience.

I HAVE described the first rise of all entities, organic and living, vegetable and animal, out of matter thus far inorganic and lifeless. I have just delineated how primary individuals organic and living, themselves not produced by other prior entities of the same sort, nevertheless became capable of in their turn procreating similar later entities. But these two different successive phenomena of nature—the first of which only produces the existence of single unconnected individuals, and the latter of which produces individuals connected with other later individuals of the species—are separated from each other by other intervening phenomena of nature which, especially when organic entities are of the animal sort, and become in their organs and faculties more varied and more complex, also become more multifarious and more striking. Of these phenomena in higher animals I shall here give a rapid sketch.

I have said that various elements of opposite sorts, the one aerial and coming from on high,

and the other aqueous and coming from underneath made to meet, were first, by the opposition of pressure centripetal and centrifugal compressed together in a nucleus, in organic entities of a vegetable sort called seed, and in organic entities of a sentient sort called ovum. That the elements of this nucleus or germ first from radiant and gaseous became liquid and lastly solid. That, as from without fresh elements of the same sorts with those that had first formed this germ continued to flow in it, they combined in the same in its later more internal parts called proper; that while these more internal parts proper remained imprisoned in the more early and external parts called placenta, and thus continued deprived of the more immediate contact with and influx of external air, the organs of vitality, sense, intellect and voluntary reaction outward of which they were composed, did not acquire their last maturity, and the possession of their higher faculties. They already enjoyed life, but not yet sensation, thought, volition, or the power of executing those actions which proceed from will. We have seen that at last, by the growth which continued influxes from without, through the medium of the placenta, give the parts proper, these parts proper are made to press outward against this earlier and more external envelope or receptacle or base called placenta, which first had served them as mould, and next, as they grow, had cramped their

development, till at last it bursts; when, like the cotyledon of the lowest plant, the placenta of the highest animal, ceasing to be drawn upon by the parts proper no longer tarrying within it, but rendered useless, and deprived of its power of suction, ceases to live, is cast off, and left to decay.

Meanwhile, the parts proper themselves, liberated from their former confinement, do not, it is true, for the first time, permit external elements to enter the pores of their external surface, and their internal alimentary canal, since in certain quantities they had already, through the medium of the placenta, entered both, but enter them more unrestrained, and in greater quantity; and thereby cause the stomach and lungs to become inflated, to manifest sensible exhalation of the carbon, in the veinous blood rising to the lungs, and sensible inhalation of the oxygen from air, in the veinous blood remaining, called breathing, which causes more of that blood from veinous to become arterial, increases the proportion of arterial blood to that of veinous blood, and gives this arterial blood a greater pressure, and a different direction. This meeting of elements from within in greater quantities with elements from without, produces the maturation of the organs sensitive, mental, and those experiencing voluntary reaction outward, and enables the animal to begin feeling, thinking and acting voluntarily.

The different senses, not till then by elements from without sufficiently matured to be opened, and rendered sensible to the influx of these elements, now receive these in the same order in which they had erst contributed to the formation of these organs. Those of touch expand, and become sensible first; next those of taste and smell; and lastly those of hearing and of sight.

The grateful feel of the mother's genial warmth, the pleasing pressure of her soft body, first make her offspring press to her bosom, and nudge between her breasts; next comes the attraction of her effluvia and odour.

The greater influx of external air, causing in its turn a greater abundance and efflux outward of gastric juice in the stomach, causes this stomach, thus far only fed by the mere air that oozed in, to crave more substantial food; and the lips that edge its prolongation and orifice pressing against solid bodies, where there is a nipple overflowing with milk, without intending to do so, draw this milk out, and convert the same into food. Thus also the sense of taste becomes gratified, and what had been first unintentionally experienced, becomes afterwards, from the grateful recollection it leaves, intentionally sought.

The organs of hearing and of sight have their turn to mature next. The eyes, though formed of the fluid or substance of light, first seem like

marble balls impervious to its further influx. As this influx increases, however, they by degrees mature, become transparent, and receive sensations, first of light only, next of colours, next more distinctly of the forms and movements which the arrangement of these lights and colours produce. The infant already squalls with delight at the sight of the moon, at the beholding of a candle, while it still is insensible to the hues of a rose or a carnation. The young animal, at first only able, through organs of feel, spread over the whole surface external and internal of the body, from a few objects not more extensive than that body itself, when in contact with it, to receive a few sensations of feel vague and indistinct, at last becomes able, through organs of sight only contracted to the size of the small pupil of the eye, from objects as wide asunder as the poles, and as distant as the farthest star in the firmament, to receive impressions distinct and definite.

In inferior animals, however, when they first issue from the ovum, the organs of the inferior senses alone seem formed, or at least completed, and fit to serve their purpose. They still have to pass through the condition of chrysalides, before new and greater influxes from without, with more blood from within, compose or finish the organs of the higher senses, which, by the husk of the chrysalis bursting, and laying bare the

parts found underneath, are made to appear and to commence their office.

The maturation of the organs of vitality, and of those of sense superstructed on them, is again succeeded by that of the organs of mind, of thought, of volition, and by that of the organs of voluntary reaction outward, superstructed on the former ones. The animal, having first felt, begins to recollect, to think, to desire, to feel aversion, to will, and to react on things without in consequence of that will.

CHAPTER IV

Sleep.

I HAVE already observed that on different parts of the surface of this globe, the transition from the period of day, when the elements poured out by the sun press strongly upon, and flow copiously in the pores of all organized entities vegetable and animal, to the period of night, when this pressure and influx subside, and when of the elements from without, already absorbed in the body, a portion is again permitted from this body to emanate, already, even in many vegetables, causes the more delicate parts, made in the daytime, in consequence of the fluids they retain, to display a swell, an orgasm and a tension, at nightfall to lose these, to collapse, to close, and to present a sensible sleep.

In animals this sleep is more evident. The external organs of the various senses, then by external influxes less solicited, less filled, are then also left more to return to the collapsion they retained while the animal was in the ovum, the placenta, the womb. They are thus made to shut out the few impressions from without—the few im-

pressions of actual present external modifications, which otherwise might still assail them; and to cease receiving from without any further sensations of feel, taste, smell, hearing or sight. The arterial blood from within, which driven to the surface of the body during the period of watchfulness, there finds a vent, by mixing with external elements in nervous fluid, producing impressions and sensations of external objects, now, for want of that sort of vent, causes a greater general flush, and a more sensible perspiration.

On the one hand, an excitement greater than usual from within, causing more blood than usual to flow outward, and to solicit more elements from without than usual to mix with it, and even of feeble influxes from without to produce impressions and sensations, may retard the hour of sleep long after nightfall. Children much amused long resist its advances. These advances will likewise be prevented by a greater influx and excitement than usual from without,—by artificial sounds produced and prolonged during the silence of the night,—by artificial lights kindled after that of day has set,—by a strong shock or commotion, or joy or fear produced, and promoting more attention, more determination of blood from within to the external orifices of the sensual organs,—by the intensity of thought and the agitation of mind, which we cannot repress.

On the other hand, an exertion of the external

parts merely vital and insentient, or sentient, greater than usual, strong bodily exercise, great influx of external elements, intense attention bestowed on these, and whatever of the blood driven to the surface causes a great and a speedy exhaustion, by sooner than usual causing the quantity of blood from within necessary, with influxes from without to mix in the nervous fluid, required to produce impressions and sensations of external objects, and by leaving the external orifices of the organs of sense to collapse and close, will advance the hour of sleep, and suffer it to overtake us even at midday. Nay, a movement, a sound which we experience, unaccompanied by any mental effort of our own calculated to employ the faculties of the body, or even the attention of the mind, but sufficient to divert that mind from all impressions more varied and more exciting—the sound of a drowsy ditty, the say of a prosing companion, the seesaw of a rocking cradle, the rustle of a murmuring brook, the reading of an insipid tale, the very sight of the hands alternately opened and closed with monotonous regularity, may advance sleep. As too great excitement prevents, too great lack of such excitement, called ennui, promotes sleep.

In higher entities, at the approaches of sleep, the veinous blood from within drawn to the lungs with less alacrity, and the carbon in that blood left to accumulate during a longer time, without suf-

ficient vent, at last produces in the muscles of the throat and mouth a convulsive yawning, which favours its escape; but as sleep becomes more confirmed, and more arrests even the pressure of elements from without on the lungs, yawning itself again ceases.

After sleep has lasted long enough to leave the blood, rising from within to the surface, there to remain unconsumed by elements from without, to refresh the organs of sense, to refill these, and to reproduce in them orgasm and tension, they again awake, and reopen to impressions from without, and renew their communication with the external world. While they are very young they are soon exhausted, and soon lapse in sleep. Infants, even in the daytime, have frequent and long intervals of sleep.

CHAPTER V.

Hybernation.

In many parts of this globe, not only the more rapid change from day to night, but the slower transition from summer to winter, by diminishing the influx of heat and other elements emanated from the sun, and leaving on earth substances more to have, by consolidation, their circulation in organized entities, and their keeping up in these entities of the faculties of life slackened and stopped, produces in them a sensible effect.

In vegetables of a more delicate description, the want of sufficient heat already, by causing the fluids to have their circulation stopped even before they reach the parts which they were destined to feed, and to be consolidated prematurely in their progress through the vessels, causes the leaves already expanded in outward air, for want of further influxes from within, to starve, and to drop off; and prevents the leaves still skulking within shelter of the stem and branches from being pushed out and made to expand.

It causes in animals of inferior sorts first, by the slackening flow of the nervous fluid, the

organs of sense first to merge into a sleep more lasting than that of the night, and this sleep next from these to penetrate deeper into the system, and it ultimately even causes, by retarding the circulation of the blood and lymph and chyle, the action of the stomach and the lungs to be enfeebled, the functions of sensible digestion and breathing to be stopped.

The disinclination to excitement, the torpor, the drowsiness stealing upon the animal, especially when of naturally slow circulation, then makes him lose his appetite for food and fresh absorptions from without, withdraw from the garish eye of day to dark places, where, favoured by surrounding obscurity and silence, he yields unimpeded to the total sleep of the senses, and to the great diminution of the vital powers—to that hybernation, which lasts till the warmth of spring, penetrating their abodes, again awakens and makes the torpid animals revive.

In their state of torpor reptiles are in their subterraneous abodes found huddled up as if transformed into stone. Bats and birds are discovered suspended from the ceiling of their caverns as if dead;—experiencing on the one hand no further influx, and on the other no fresh deperdition, no decombination, they may remain for years, while the cause of their hybernation lasts, in that stationary condition. Whenever they are again, by the influx of elements from

without, made to awake from their trance, they feel their compressed lungs, again inflated, dilate, their blood again begin to circulate; they again unfold and stretch their bodies, and again made by new excitements to feel the wants of life, they again return to light, and resume their former functions.

Higher animals, possessing more internal warmth to oppose the influx and action of external cold on their fluids, seldom hybernate; but when cold without is so intense as irresistibly to cause the sleep of the sensitive parts, and by degrees the torpor of the vital organs, it generally causes that sleep, unless counteracted in time, to end in death.

CHAPTER VI.

Dreams.

I HAVE already shown that the sleep of the external orifices of the organs of sense, though calculated to prevent the influx of elements, and the impression and sensation of modifications directly from without, affords no reason why, in the internal organs of the mind, the internal circulation of the nervous fluids should stop, and cease to produce those recollections of prior impressions from without, during that absence of fresh sensations directly from without, peculiarly called dreams; nay, in entities that between the papillæ of sensation and thought have those internal ducts of communication which, even while awake, facilitate the production of images, of which the component parts present in time and place an order different from that presented by the component parts of sensations from without, should not, during sleep, and while the nervous fluid is less under the control of sensation from without than during waking, produce images even more extravagant than waking thoughts, and which yet, while

sleep lasts, and while no opportunity is afforded for comparing them with actual impressions from without, are taken for sensations of external objects, and are only recognised as thoughts and as dreams when afterwards recollected on waking.

In general, sleep penetrates sufficiently deep in the system to stop not only impressions from without inward, but also, of the nervous fluid through the medium of the will, the reaction outward on the muscles of voluntary movement. In most entities during sleep the internal will is followed by no corresponding external effects. If we labour to talk, the voice expires on the lips; if we strive to move, our limbs appear of lead—they seem palsied and fettered.

In some human beings, however, sleep seeming to take a hold less profound, leaves the will at liberty to react on the external muscles. Some people in their sleep utter words, and even perform actions, conformable to their peculiar thoughts and desires. Uninfluenced by impressions from without, these words and actions are not conformable to external objects, and often the words and deeds of a somnambulist lead him into serious mischief. Sometimes, again, where the mere apprehension of an external danger perceived would cause the evil apprehended to happen—when the mere trepidation produced by the fear of falling would occasion a fatal fall—the state of sleep, which conceals that danger, prevents the mischief.

CHAPTER VII.

In organized and living entities, vegetable and animal, the causes of growth, of puberty, of later cessation of growth, of decline, and of death.

WHERE we see organic and living entities, vegetable and animal, first beginning in a hardly perceptible solid speck, thence, by degrees, grow perhaps to millions of times their primitive size, and next, again, gradually cease to grow, and become stationary till they again decombine, dissolve and vanish in circumambient air, two questions naturally suggest themselves to the mind: first, how came it, that from so minute a beginning they were gradually made to grow to so great a comparative size? and, secondly, having had the faculty thus long to continue growing, how came it that at last they ceased to grow, and became stationary?

The first of these questions I have already answered in my description of the organs of organization and life. I have already shown, that where an entity is organized, new opposite elements, similar to those of whose combination it

was first composed, continuing from without to be admitted in, and to combine with it, must, to a certain degree, to its former parts add new parts more extensive.

The latter question I shall answer now—beginning to do so by rectifying an error.

It is generally supposed that, in organized and living entities, the faculty of procreating, called puberty, stops individual growth. The contrary is the case. It is the gradual diminution of individual growth: it is the elements poured in no longer finding means either to combine in the body with its former solid parts, nor yet to flow out of the same as they came in, that, by keeping these elements pent up in the body, there forces them to form the germs of new individuals distinct from the parent, which by degrees detach themselves from that parent, and which thus by degrees produces puberty and the power of procreation. Puberty is not the cause, it is the effect, of the diminution and stoppage of individual growth.

The influx of new external elements, which, as long as with former elements already combined in the body these new ones find room to cohere, naturally increases not only the external size but the internal density of that body. At last, however, their circulation is by that increased density itself arrested, prevented from reaching the spot where the new incoming ele-

ments might, by combining with former parts, still further increase the size of the body outwards; and it is then that further external growth gradually diminishes.

It is then, also, that of the incoming elements a part, neither finding room in the body, on the one hand, to combine and cohere with its general mass, nor, on the other hand, wholly again to flow out of it in the shape of different ejections, first in part again repelled, is made to ooze outward in lesser streams at the different principal extremities, and then, with air from without, to combine in the shape of additional down and hair, and feathers, or even horn and others, such as begin at a certain age to adorn certain parts of animals, and to display the external signs of approaching puberty. It is then also that of these incoming elements a greater portion, driven to the genitals, which a former portion of elements, not finding room elsewhere, had formed, and there accumulated, at last, by its titillation, causes new desires, and is made to spurt out in greater torrents, able to form or to contribute to the germs of new individuals like the parent.

After the body has, by the increasing pressure from without on its more extended surface, become prevented from any longer from within growing outward in general dimensions, it still is, by the further influx of external elements, for

a time made to grow outward, in the density and vigour of these intermediate parts, which meet with less resistance from without.

Even vegetables, after they have ceased sensibly growing in the face of centripetal gravitation, in perpendicular height, still continue growing, where they meet laterally with less opposition, in width and in diameter. Animals after puberty still grow in internal density, vigour, and squareness; and in human beings, each individual muscle visibly becomes more full, more dense, more swelling against the next muscle, more distinct from that next, and the whole collective frame consequently more vigorous, and more powerfully knit together.

According as in vegetables the wood, and in animals the muscle sooner acquire, in consequence of the influxes preponderating over the effluxes, in addition to that external length, that internal density which stops all further influx and combination, except in as far as prior efflux and decombination make room for it, further growth ceases on all sides and in all senses. In some plants a single season brings about this period; in others centuries are required for the purpose. Some animals cease their growth in a single day. In fishes, whose muscle is, from the element in which they are born, very lax, growth does not appear entirely to cease as long as they live. In human beings

growth is generally limited to from fifteen to twenty years.

When puberty is carried to its fullest extent; when the living entity enjoys, not only the greatest individual size and vigour, but the amplest power of procreating his species, nature seems to have raised him to his highest pitch of physical perfection. Now let us see how from this he again declines.

The common belief is, that at first, and before the existence of sin, entities of an organic and living sort were destined never to lose their life—never to die.

If so I can only repeat, that the whole modification of this globe must, before the fall of man, have been different from what after that event it suddenly became: that the present state of things can hardly be considered as a further development, a connected change only of the former state of things: that it is nothing less than a total subversion of the same: that before the fall of man, vegetables and animals born cannot have grown, cotyledons and seeds have expanded and dropped off, leaves have fallen, blossoms have decayed, fruits have ripened; since all these phenomena already are accompanied by different forms of decombination and death: that animals born to procreate indefinitely, without being doomed to make way for the posterity they raised, must

have found themselves sorely stinted for room, when no longer finding any such around them.

But leaving alone what has not come to pass, I shall only say that on this globe, as it now is, decline and death follow so closely on the heels of life and growth, that the very first later influx in vegetable bodies already combined, which in them produces further consolidation of new parts cohering with the former parts consolidated—which produces in them life and growth—if in producing new parts, cohering with certain of the former ones, it also again of others of the former ones, by pressing on these, produces the loosening, the decombination and the exit, already causes a beginning of decombination and of death, although, while that decombination of some parts is accompanied by life and growth of others, more extensive and more luxuriant,—while it thus remains partial only,—is not yet called death. Even of many vegetables, and still more of all animals, certain parts die away entirely, and drop off before others attain their maturity, or are so much as made to begin. Of plants, the seeds, the base, must have their external husks and foundation drop off and die before their internal germ finds room to expand and to develope their first leaves. Those leaves must again fade, and make way for others, before out of these can rise the flower; of the flower the corolla drops off and dies before the fruit can swell and grow. Herbivorous

and frugivorous animals cannot carry on life without condemning foliage, flowers and fruit even to premature destruction and decombination. As of vegetables the seeds and colyledons, so of animals the ovum and placenta must be cast off before the germ, the parts proper within, can be developed; and certain animals of a carnivorous sort cannot live without dooming to death, even before their natural time, such herbivorous animals as before had committed similar havoc among vegetables.

In man the death which he experiences and causes involuntarily, and from the very impulse of his nature, still is more frightful. He must live, and grow, and develope amid ruin and devastation more extensive. Before he begins to feel, he must already, in bursting from his envelope, leave it to lose its former life: later, every day parts of his component elements dissolve, while others are combined; he loses some of his incipient forms and faculties, while he gains others higher and nobler; nay, after he is said entirely to have died,—after all his finest faculties, not only of body but of mind, are irrevocably gone, —his hair, his nails, his beard for a time still live and grow.

After God, the first author of all that by its combination produces life, and that by its decombination again produces death, and after time, space and gravity, centripetal and centri-

fugal, the earliest known offspring of God, and the parents of all later modifications—that modification called electricity, is the one which, under the name of cold, while producing a certain degree of condensation and combination, and, in substances combined, a certain suction of fresh elements, still fluid, first in them causes life; and which later again, by the inverse ratio of its former movements, under the name of heat causes substances before combined again to lose their faculties, to become unable to take in further elements from without, and causes them after death again to dissolve, to decombine, and to lose their very form.

All later and more partial immediate causes of death, and of subsequent dissolution, are only later and more partial effects of the earlier combinations and decombinations of opposite electricities—of those producing cold, and those producing heat. If a man is killed by the pressure and cut of a hatchet, it is electricity of a combining sort and productive of cold that has first formed and next combined and solidified the elements of the steel of which the weight and pressure have severed his neck from his body; and if man is left to die a slow and lingering, but, so called, natural death, it is that the same electricity, which first drove together his component organs and gave them life, that since has by degrees in them produced such a density that,

unable to let in fresh elements required to replace those flowing out, he is both from repletion and from want made to lose his life. This event in the ephemeris already happens the very day he is born, while of the raven and the crow the useless existence last, they say, a century.

I shall conclude this chapter by the picture of the effect of the aforesaid cause in the natural death and dissolution of man.

Some entities of a sentient sort, such as zoophytes, have no internal alimentary canal whatever. In them, as in vegetables, of external elements, the influx, circulation, and efflux is entirely carried on through the pores at the external surface. In them also the whole of the obstructions which impede indefinite extension and duration must begin solely at that external surface. In those higher brutes, and in human beings in which somewhat later, by the partial pressure of outward air on the external surface, part of that surface is doubled inward and indented into an alimentary canal—into a stomach and lungs—the coats of these internal parts are, like those of the external surface, throughout lined with pores, at which later and more circuitously, of a branch of the external elements begins a regular secondary influx, circulation and efflux.

Of external elements, the continued influx be-

gins first in the external integuments and pores —in the muscle of the body and limbs—to produce a density which by degrees impedes their power of suction and of taking in fresh fluids. These fluids then begin to be absorbed more feebly, in less quantities, and in smaller proportions, relative to the organs whose elements are within decombined, and thence again driven out. Less lymph, less chyle, less blood veinous and arterial are formed, and made to replace the fluids already evaporated before, and to afford matter for farther evaporation. In the external parts a general lessening of swell, of elasticity, of vigour, a general wasting, debilitation and torpor become visible. Less filled, they lose their tone, their power of resisting pressure; and while the body of the limbs becomes flabby and yielding, the joints, less lubricated, become stiff and rigid. The external skin, less alive, and therefore more tardy in shrinking than the parts within, begins to hang about these latter loosely and in wrinkles; and that skin, no longer moistened by an insensible perspiration, becomes dry and parched.

For a time the internal pores of the alimentary canal still continue to perform their office. The breathing continues unimpaired, the appetite good. As external absorptions lessen and become weak, those within seem alone to fulfil the whole task of supplying their place: but the

time comes when these also begin to fail; the breath becomes short, the appetite enfeebles, the digestion becomes weak.

We have thus far only described the decline of the fundamental vital parts external and internal.

At the external surface less blood from within drawn out, and less elements from without pumped in, combine in less of that nervous fluid, which feeds and causes sensations in the organs of sense. These organs receive of external modifications impressions less vivid and less frequent. They lose their acuteness. That pleasure which before they afforded, unsought and without effort on our part, they now only reluctantly, and when studiously their impressions are sought and are dwelt upon, continue to afford. Sensations of touch, which before would set the frame on fire, and produce a thrill of pleasure, now glide over the body unheeded; delicate wines and rich viands sooner pall upon the taste, and more want the stimulus of spice and relishes; the perfume of the rose and jasmine no longer fill the sense with gladness—the balmy breath of spring no longer produces ecstacy in the spirits. The most heavenly music, though still approved and relished by the scientific ear, would no longer vibrate in the mind, nor, after ceasing to strike the sense, continue to haunt the memory. A fine view would only be beheld

with calm content—a handsome female, like a beautiful vision. We would seek the charms of internal objects from recollection of the feelings they once had inspired, more than from the idea of their occasioning fresh raptures.

As the internal vital parts would retain their moisture and tone longer than the external surface, so would the internal organs of the mind retain their succulence longer than the external organs of the sense. As we received fewer present sensations from external objects, we would from a greater distance in the memory recall past sensations, and in the imagination anticipate future sensations. Those of infancy, during the period of youth and manhood laid by, or eclipsed by other more vivid perceptions of passing objects, would, when that present began to lose its charms again, with more minuteness be summoned up; those of old age would inspire greater solicitude; all the mental lumber of past times, long laid by and forgotten in the furthest recesses of the memory, in order to give way for the enjoyment of more recent events, for the forming of more proximate projects, would again be revived, be dragged forth into sight; we would be more sluggish in action, but more intent on contemplation. The travelled man, who at different periods of his life had visited the same scenes, performed the same actions, would be astonished to find that on reverting to his recollections of

past times, the first and most distant in date were those that presented the impression most minute and most vivid. Even he who had never stirred from home would not be capable of travelling far back in space, at least travel back in time, further than he had done during his middle age; and, in proportion as in reality he proceeded farther forward, would in imagination retrograde further. The first dawn of life, dimmed during its midday glare, would in its evening again acquire a dusky clearness, and from afar spread forth a new twilight. We are struck late in life again to behold in our mind the events of our childhood, long consigned, as we thought, to irrecoverable oblivion, reappear like flitting phantoms. Of friends long gone by, the spirits again start up, again hover before our eyes, again converse round our couch.

If we still, from old habit, busy ourselves with the living, it is only as they are going to replace us. We toil for their benefit, their pleasure, their recollection of us—the name we shall bear on their lips, the feeling we shall leave imprinted in their hearts. If we still give our attention to trifles, it is to trifles which to them will seem of importance. It is about the permanence of our fame, the interests of our posterity, the completion by others of the works by us begun, that we feel solicitous. But while in infancy each day, filled with a thousand minute objects, seems to us a year, every

year as we advance, on retrospection, seems a shorter hour. It follows its predecessors with more rapid strides. Yet the long and frequent sleep which shortens the real sentient existence in infancy, in age is become a light, uncertain, oft-interrupted dose.

After the body had begun to weaken and the sense to blunt, the mind would still for a time preserve its brightness, like a flame that burns clearer as the fuel that supports it is consuming. Concrete ideas would more run into abstract thoughts, mere facts more into inductions: thoughts would only be prized as they led to inferences; and as fewer new ideas would occupy the mind, the old ones would become more methodised, and be arranged in more lucid order.

Presently, however, our cerebral apparatus would begin to partake of the general debility of the body. The cerebral fluid, becoming torpid, would cause the imagination to stagnate; the very memory, the storehouse of the mind, would fail. We would forget, first names, next facts; at last we would perhaps fall into complete dotage. We would, in the very midst of our friends, cease to recognise their voice. Of the brain, fast shrinking, the ducts, no longer moistened, would dry up, and, like the wasted kernel of a nut, begin to rattle in their case. But it is lamentable to think, that often the cessation of drain by the

mind may for a time again, by leaving the body better supplied, prolong and restore to their functions the organs of mere vitality.

The organs of sense, long dimmed, would at last, one by one, entirely lose their faculties; they would depart in the inverse order of their arrival. Loss of sight and of hearing would loosen and remove the ties that attach us to external objects; palsy would cut off our communication with them. The organs of reaction outward, first in the ovum only by pressure of its integuments from without huddled together, would now, by failure of support from within, again collapse; the hand would no longer afford a firm grasp, nor the feet give a firm support. The one would tremble, the other totter under their load. The very stays of the body, the bones, would waste away, would become spongy and brittle. The teeth, no longer pressed in their sockets, would drop out of their sheaths; the hair assumes the hue of winter.

Brutes, when the torpor of sleep, of hibernation steals upon them, fly the light, hide themselves from the aspect of their comrades in dark places. Such they retire to at the approach of death. Thence, while such numbers die every hour, so few with their corpses strew the ground.

Man is suffered to make his exit less quietly: friends surround him; watch his last breath;

seem anxious to know when it takes its flight, whither it shapes its course.

Finally, all further suction of external elements by the body ceases: all circulation stops. The extremities become cold and stiff, while in the vitals alone the blood still for a few moments retains its fluidity. The very exsudations, unable for want of vital warmth to evaporate, fall back in clammy sweat on the skin. From the lungs, exhalations no longer perceptibly pass the lips. The icy hand of death grasps the very heart. The last spark of life becomes extinct: the last drop of blood congeals: the last movement stops: the machine, so curiously formed, once so sensitive, is become a mass of mere lifeless clay.

Seventy years or thereabouts is the period usually allotted to man for the performance of this awful round, from birth to extinction, from life to death; when regularly performed, when not hastened by accident or by disease. In that short period he takes leave of all his vast views, his wide prospects on this earth.

But death is not always followed immediately by the entire dissolution of the elements so combined as to produce life. Where heat and humidity are wanting to bring about their total separation, their internal forms still long endure after the spirit is fled. At last, however, all must decombine, and what first came from higher

globes in the shape of radiance, in the shape of radiance reverts to higher globes. There, probably, the elements of this existence recombine in a form more extended, more durable, more perfect: capable of enjoying greater bliss, and liable to suffer less pain.

CHAPTER VIII.

Introduction to human art.

We have carried to his end on this globe the man of mere nature. It is time that we should contemplate that man remodified by art.

The mere vegetable is not yet susceptible of feeling any privation, any pain. It has not yet any purpose of its own to effect. If it answer the objects of other sentient entities, theirs is the pleasure: if it disappoint these, theirs is the pain.

The lowest of brutes seems provided by nature with more means of happiness than of misery. The oyster immured in his tenement, tied to his rock, can of cold and heat, of food and drink, and of whatever else he may want or wish for, by merely opening his shell obtain as much as he desires, and by merely again closing that shell, exclude what more would annoy him. If by adverse fate torn from his native bank, if cast upon the shore, if left dry and destitute, he is picked up, is by a blunt knife scooped out of his receptacle, is swallowed by man, he foresees not his fall, he is made to abandon life with little pangs.

On looking higher up, on beholding certain insects, which, like the butterfly, almost disdain to touch the earth, almost live in pure air, dwell on flowers, feed on honey, bathe in their fragrant dew, live only for love, and seem immersed in a sea of sensual delights, we would at first sight think them the happiest of beings.

As the pangs of the mollusca so the pleasures of the moth still are less intense than we fancy.

With a body still enclosed in a hard insensible husk, a proboscis still encased in a horny tube, eyes still dim, in proportion to the extent and diffusion of their foci or pupilli, blood still cold and torpid, senses still sluggish, a mind still necessarily contracted, able only to call up recollections few and slack, unable to add to the pleasures of the sense the higher enjoyments of the thought; of multiplying the gratifications received from the present by any joys derived from the memory of the past or the foretaste of the future, the insects, beheld with such envy while they flutter about from the rose to the carnation, are yet incapable of sipping delights so intense as those we fancy.

It is true, that, susceptible of less happiness, they are also inaccessible to fewer pains than we imagine.

Nature has more immediately and spontaneously given them all they want for enjoyment: all they are capable of enjoying. By the regu-

lations of that nature each sentient entity is only produced of, and thus among the elements that suit him. Finding himself surrounded by the materials on which he is destined to subsist, the irrational animal is never tortured by the want of such objects as he finds not easily and spontaneously around him.

Even if by the blind fury, or the wants or even wantonness of other entities, injured and destroyed, the insect only in this destruction suffers sensitive pains very trifling.

Shakspeare has said, and in beautiful verse, that the worm crushed suffers pangs equal to those of the giant destroyed: and he has done right. It is well to soften our nature to what cringes defenceless under our feet: but Shakspeare is wrong as to the fact. Entities that have not yet nerves capable of concentrating their feelings, as they are unable to enjoy pleasures very intense, are also incapable of suffering pains very excruciating. If a fly have a leg or a wing torn off; if he get singed by the flame of a candle, or is by a merciless collector impaled on a pin, the feel of having his powers of movement curtailed is, perhaps, the direst of his sufferings. With a hook transfixing his bowels, the fish is not prevented by the pain from snapping at another baited hook. When we see the intestines of a larger moth become the nidus in which breathes a smaller fly, which, before its eggs are hatched, itself in turn has the

offspring of a still smaller moth again deposited in its own vitals, we shudder at this concatenation of tortures: but, perhaps, we suffer more mental sympathetic pains than the patients themselves feel in reality. When we roast lobsters alive, skin eels without the mercy of first cutting their throats, whip pigeons to death to make them more tender, swell the livers of live geese by holding them over a slow fire, make brawn, by wedging pigs between two boards tied close, we have not, perhaps, the power of inflicting on them torture equal to what our conscience upbraids us with.

Thus little able to feel present bodily pain, inferior animals are unable to retain of sufferings past any recollection; still more of those to come to feel any anticipation. If they try to avoid a rude contact, to fly from an impending danger, it is only in consequence of some impression made by internal elements on their sense of feel, or smell, or hearing, or sight, similar to that which makes man himself, when suddenly approached by some opaque object, involuntarily close his eyelids. It is a mechanical movement, unaccompanied by thought, by mental pain, by fear.

Without hope delayed, without apprehension of mishap, the millions of insects that every hour fall victims to the fury of the elements or the voracity of higher brutes and of man, embitter not the existence of those that survive.

It is only animals of the higher species, in whom on the vital and sensible organs is superstructed a nervous system more complex and more concentrated, that owe to the same the capacity of combining more sensations, of retaining of these recollections more ample, and thus of feeling not only pleasures more intense, but pains more grievous.

Even the highest of brutes however, still destitute of the mental faculties of abstraction, are not yet liable to the excruciating agonies which from these latter may be derived. In addition to his personal sufferings, no brute can suffer from sympathy with others.

Man alone has by nature been brought forth unable, without assistance, to cope with her spontaneous gifts or inflictions: of many elements of which she is sparing he suffers the want and privation: of many others of which she is liberal and profuse, he experiences the oppression and weight. His skin is so fine, so destitute of general additional covering, as to suffer equally from the extremes of cold and of heat. He alone has a stomach so feeble as often to suffer from food in its crude natural state, and to suffer still more from its insufficiency. He is by hunger doomed to dreadful torture, by thirst made to feel excruciating pain. Yet is he alone, with a heavy body and with sluggish limbs, with obtuse teeth and with truncated

nails, deprived of the means of effectually pursuing, prehending, and tearing to pieces his prey, on earth, or in water, or in air. He is by nature as little fitted for defence as for attack. Even from the sting of the mosquito he has no natural protection: the effluvia of the wild beast give not his senses a distant warning, as they do herbivorous brutes: and his tooth he cannot repel when near. He suffers more also from the recollection of past privations and sufferings, and from the fear of those still to come. Exposed from his birth to a thousand vicissitudes from which the brute is exempt, as his faculties develope he becomes liable to sufferings more intense and more varied.

Thus, however high we may from habit have rated the condition of man, even as first coming out of the hands of nature—however much we may have been taught to think him the most perfect, as he is the most complex of known beings—if perfection consist in possessing all the means required to accomplish the end purposed, and if the end purposed in creating sentient beings must be their happiness, we may fairly say that man, as he issues immediately from the hands of nature, instead of being the most perfect, is the least perfect of created entities.

But man alone, if doomed directly at the hands of nature to suffer both from her parsimony and from her profusion; if by her ren-

dered liable to many wants and privations, from which he alone has been capacitated to suffer great pain; if he alone has been threatened with many inflictions, from which he has been made to experience still greater agonies, has alone likewise from nature received intellectual faculties able to frame the means of overcoming these misfortunes, and to combine her materials in such a way as actually to ward them off.

He alone, where his natural covering is too scant to protect him from heat or cold, has received the faculty of contriving an artificial clothing. When he finds his food too crude, he alone can improve it by cookery; he alone, if he fears the sting of the insect, can interpose the ægis of attire; he alone, if deprived of natural means of attack and of defence, can devise others artificial more extensive, more rapid, more effectual; he alone, in the midst of penury, can by his own labours produce plenty; he alone can, though only through the medium of additional toil, to the reluctant bounties of nature, add all the resources of art; and of these, as human beings rise higher, as their sphere of actions and of sufferings becomes more extended, as more are wanted, more are invented, are found.

Of these resources of art I shall therefore now give a rapid sketch, beginning with those most urgently wanted to alleviate the mere sufferings of

the body, and proceeding on with those calculated to allay the cravings of the mind; at the same time begging leave to observe, that all contrivances of art, only wanted to correct the deficiencies and to prevent the privations incidental to this imperfect globe, can only apply to its peculiar modifications, and can be of no use with reference to a future, better world.

CHAPTER IX.

Beginning and progress of human art.

Every where in man the sufferings of the sense first set the mind at work to use the bodily means and materials, afforded by the climate and the soil, for their alleviation.

Already in the wildest state, the warmth of the sun, or the coldness of the atmosphere, the fury of the elements, or the sting of the gnat, the fang of the wild beast, or the violence of other men, would suggest to man against them some means of protection or defence. Man would, if residing on the seashore, of the fish he catches for food use the oil, if dwelling inland, of the beasts he devours employ the grease, to anoint his vulnerable skin. He would rub his body with clay or other ready substances to inspire terror to whatever adversary was susceptible of such a feeling. Where these means proved insufficient, he would of the animal of which he had swallowed the flesh, wrap round his body the coat. He would, like Hercules, stalk about in the skin of the lion.

Less nimble than the fish, less active than the

four footed brute, he often found it difficult, with the bare use of his unassisted limbs, to cater for his stomach, to appease his hunger. He wrests from the ground some stone or stick; sends it after the fleeting animal, and from a greater distance more speedily overtakes and lays prostrate his prey. He learns to forge weapons offensive and defensive. The meat contracts a taint before he can consume it. On the seashore the brine of the wave is seen to preserve, inland the heat of the sun to dry it. He exposes to these his aliments, and learns to render them more lasting and palatable by condiment and cookery.

From the fleeting brook, from the flat surface of the pool, his level mouth laps not the water with ease, like the peaked snout of the brute; he can only with his fingers bring the liquid to his lips with great loss. Hollow clay or convex stones—by the seaside, shells cast on shore, inland, seed husks, dropped from the trees—are seen to hold the rain water; he converts them into drinking cups. He forms his first utensils.

When weary in the daytime he sits down on the ground. At night he reclines to sleep. The roughness of the earth hurts his limbs. With moss he softens its asperities. With the skin of the beast he covers his couch. Thus he contrives furniture.

He cannot always carry about with him what-

ever at times he may want. If for the immediate protection of his body he requires clothes and armour, to these again he adds utensils and furniture, for the preservation of which, he wants some covering more capacious and more stationary. Of some production of the soil—of its mud, its stone, its seeds, its foliage, its wood, even of the hides of its brutes which he has slain, he builds himself a hut. The savage of Austral-Asia digs a hole in the sand; the New Zealander creeps in a hollow tree. Elsewhere stones are piled up in a cabin, rushes form the roof; rude trunks of trees precede the marble columns of the Grecian temple.

The life of the mere fisher or hunter is a life of alternate famine and repletion; superfluity and want, toil and torpor. It is a life in which each man always beholds his neighbour's hand lifted to wrest from him what he himself most urgently wants, most dearly has earned; in which he always wishes to take away the life of every other man, only in order to secure his own. It is a life little removed from that of the most ferocious brute.

Yet many men, whose sense is not active enough to derive from that life much suffering; or whose mind is not fertile enough to devise the means of improving their condition, go no further in art than some contrivance for fishing or for hunting. Stop there in their attempts at

civilization. Content with some fish bone to harpoon the fish who still cleaves the wave; with a club to fell the beasts, that sweep the ground his invention goes no further. What he wants he pursues; when pursued he flies, or defends himself; when sated he lies down and sleeps away his surfeit; only by fresh wants he is roused to fresh exertion. If declining in strength he feels unequal to the task, he lies down and dies. Resignation is to him less irksome than the trouble of contending with the ills of life.

Where the land offers pasture, where it supports animals no longer fierce, savage and solitary, only with great toil to be mastered in small numbers, and who cannot be collected and kept alive till the hour their death is wanted, but animals meek, slow, gregarious and tractable, easily collected, kept alive, and conducted; able even while living to afford sustenance with their milk, till their death is more expedient, man will learn to prefer, to the fatigue of performing in silence and in solitude, each time he wants a meal, a dangerous journey, only to attain a sustenance precarious and insufficient, at the risk of being himself devoured, the task of collecting around him these more tractable brutes; he will quit a condition in which he dreads a foe in every other human individual he encounters, for the greater ease, abundance and security of a pastoral life.

Of the hides of his slain cattle he builds himself a hut. If the beasts still alive want for subsistence a change of abode, he makes them carry his person and draw his property. To portable tents he adds some still more moveable conveyance. He contrives a carriage. No longer obliged to pursue his prey, but to drive his property before him, he moderates his pace, travels at an easy rate with his family. The improvement of his condition stops not here.

No longer fearing hunger, no longer apprehensive of meeting in every other man a being ready to wrest from him his hard-earned means of sustenance, no longer finding entire solitude his only state of security—in ease, in repose and in plenty—he feels the subsiding of the bodily solicitations of hunger occasionally leave leisure for the mental cravings of curiosity; he becomes sociable; to food for the sense he wishes to add food for the mind; he draws nearer to his fellow-creatures, whom he no longer regards as his natural enemies; he forms with them a compact for mutual protection; he associates with his neighbours; welcomes strangers; from taciturn and destructive he expands in talkativeness and in hospitality; the infant and the elder, encumbrances to the mere hunter, to the shepherd by their prattle or their prosing become a pastime and a solace; the traveller, in return for the information he gives, is offered food and repose;

for defence and for company many families congregate their tents into a camp; and, only where camps become too extensive for the territory, do their owners, like the patriarchs of old, divide and strike out different paths.

Mere animal food, unmixed, at last, where life becomes more sedentary, cloys the palate. In his idle hours the shepherd would stray in the woods, would pick some wild roots or berries, and having observed how these propagate, carry home their seeds, and sow them nearer his habitation, in order at a future period with less trouble to raise a crop more abundant. The very dung of his cattle, first cast away, but found to render his vegetables more luxuriant, is now carefully heaped up and husbanded for their improvement. From a mere shepherd he becomes a husbandman.

Discovering that of certain vegetables the saps afford a beverage more palatable than plain water, and the desires of his palate increasing with their indulgence, he would raise fruits, for the purpose of varying not only his food but his drink. After making corn cover the plain, he would make the vine creep up the hill.

His tent strikes root in the ground, his carriage rolls over its surface. He is stopped in his progress by a stream; he spies a tree fallen across the current, a trunk which floats upon its surface; the former suggests the idea of a bridge,

the latter of a boat; paddling along the shore, he finds a substance that catches the wind, and carries him out further at sea; he forms sails, oars, and at last a three-decker, that dares the wide ocean.

Many substances found in the bosom of nature eminently possess certain qualities necessary to solace the human sense, and are as pointedly deficient in certain others. Clay, stone, metals, wood, with the necessary solidity, seldom have the form requisite to adapt themselves to human limbs. Silk, cotton, wool, leather, with the warmth and pliability that afford a grateful feel, have not the cohesion and texture adapted for use. Man learns, by removing from the one its superfluities, by combining together the separate forms of the other, to fit both for his purposes. He becomes a potter, a stone hewer, a carver, a carpenter, a weaver, an artisan, and a manufacturer.

CHAPTER X.

Division of property and of labour.

THE few men who first occupy a region may have the choice of its different parts. The later individuals who spread over the soil, confined by their neighbours, must remain contented with the localities in which their fate has placed them. On these, of part of the articles they want for use and for enjoyment, they may, perhaps, with ease and facility raise or fabricate all they want, and even much more; but are, by the nature of the soil, the situation, or their own capacity and disposition, prevented from producing another part. Other individuals would again be enabled to raise superfluities of the other articles wanted by the first, and want those by these first raised in abundance. Exchanges of superfluities would thus be invented for mutual accommodation, and being found preferable to the labour of forcing nature to yield what it gave reluctantly, would thenceforth be established. Barter of produce would be reckoned upon as facilitating man's means of obtaining what he wanted for his necessities and his pleasures. For the sake of

facilitating that barter, habitations are collected in villages, towns and cities. Of the various articles of use and enjoyment, each individual devoting himself to the production or fabrication only of a few sorts, and of those only that his circumstances best suited him to, and in the production of which habit gave him the greatest expertness, more was collectively produced; and that more was of better quality. Subsequent exchange produced its general diffusion.

While some remained addicted only to hunting and fishing, others to pasturage and tillage, others would from exploring the surface of the ground begin to dive into its very bowels, tear up its stones and minerals, and seek useful metals; others devote themselves to arts and handicrafts, become artificers and manufacturers, and depend on the wants of the former, for the produce of their labour supplying them in return with the produce of their soil.

As regions do not stretch, while men increase in them, many individuals would by degrees arise who could not only find no soil to cultivate, but no raw produce of that soil to fabricate into more artificial objects of use and enjoyment, except by obtaining it from the wants and desires of others to whom they could offer an adequate return, they would offer to these the only thing in their possession—their hands, their labour, their services; and would for these obtain

in return whatever, by these hands, this labour, these services, this land was made to produce, or the productions of it were made to combine into, beyond the quantity the proprietor wanted for his own use.

Thus arose tenants and labourers, who gave proprietors their labour for part of what they could by that labour raise. When of the productions by that labour raised the part retained by the proprietor of the soil, or its raw produce, was defined, and the profit of the cultivator left to chance, it was called rent; where the portions of the produce, or of its value promised to the labourer was defined, and the gain of the proprietor by that labour was left to later luck, it was called wages, or hire.

Whatever property, in process of time, through dint of labour could be made to produce an increase, was called capital; whatever increase it produced, was called income. When the income was not consumed, but was added to the former capital, it in its turn, through further time and further labour, became capable of increasing that income.

As exchanges of produce, of labour, and of services became more wanted, some, to gain their own subsistence, devoted themselves entirely to promote these exchanges for the advantage of others, on condition of being by these others rewarded in articles of more immediate use to themselves.

They became tradesmen, shopkeepers, middle men, brokers. They established shops, markets, offices, warehouses: by degrees trade would extend; regions more distant would interchange produce more diversified. To home trade would be added foreign commerce. Long however after men had with their nearer neighbours, whose friendship and services they more wanted, established amicable barter, they would still fit out predatory expeditions to wrest from distant nations, whose property they coveted, and whose enmity they set at defiance, by force, what they desired to master without making a return. Thus the Argonauts went to Colchis to ravish the golden fleece.

CHAPTER XI.

Brutes only conceive concrete desires of actual, immediate, and definite enjoyments, not of abstract and indefinite desires of property, independent of immediate and certain enjoyment, for the sake only of uncertain and indefinite later possible gratification. They form no idea of assuming the obligation to respect the property of other individuals; of contracting with these a social tie for mutual defence, security, and benefit. Human beings, on the contrary, can conceive abstract desires of property, divested from those of immediate enjoyment; can ensure such property to themselves, by engaging to respect it in other individuals: can contract with such a social compact.

I AM now going to explain the origin of that right of property, of which those that have none to lose deny the existence, and on the sacredness of which those that have any, as strenuously insist.

Brutes with organs of sense, which, when excited, speak very loud, whenever external

objects excite these organs powerfully, and give them strong desires for the possession of certain objects, take these objects, whether unoccupied, or occupied by other entities whom they fear not, and can subdue or wrest them from. As long as they enjoy those they have occupied, they feel irritated by whatever threatens to disturb their enjoyment. The dog, while gnawing his bone, growls at any other dog who approaches him: the pigeon, by the side of his mate, pecks at any other pigeon that draws near.

But as soon as the brute is sated—as his actual present desires of enjoyment are satisfied; as soon as he feels no further actual longings to gratify, he no longer wishes to keep possession, nor even the property of what he possessed. The dog abandons his bone—takes his chance of feeling hungry again. He cannot form an abstract idea of hunger, at an indefinite future period, and of then wanting a bone to pick. He leaves the remains of the bone he gnawed to whoever may choose to take it. The lion buries the carcase he has stripped, as an object nauseous to his sense.

Even the desire of sensual enjoyment may in a brute be counteracted by his superior fears. The dog who will fly at the meat when his

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master is away, will, when his master is by, avert his eye from the dainty dish, and wait till it is offered him. He feels under the restraint of awe.

Man, with senses less imperious than brutes, but a mind more active, can in that mind form ideas and desires of things not immediately wanted, not immediately going to be enjoyed, but susceptible of being wanted, of being enjoyed at a later and more indefinite future period. He can therefore form ideas, conceive desires of possessing property, independent of ideas, of desires, of positive actual immediate eujoyment; and for the sake of future possible indefinite gratification.

Seeing himself the most prominent, the nearest object in nature, the centre of all surrounding objects, he naturally does not perceive he is to give way to any other more distant object or person: he does not see why he should prefer the wishes, the desires, the interests, the happiness of any other entity, which he feels not, which he knows only by surmise, or knows not at all, to his own, which he is feelingly aware of: nor does he at any period acquire this knowledge. Self is to the last the first object, the main spring of all his voluntary actions. All he

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does willingly, to the last still has self for its first and principal object.

At first when hungry he wrests the root from the earth, the fruit from the tree, the life of the brute, the loaf from the hands of another human being; the human being himself, when famished, he devours,—he becomes a cannibal.

When excited by lust he falls on the first woman he meets with.

Nay, as he can form abstract ideas of the convenience of other beings toiling for him, he makes brutes and other human beings his slaves.

He not only consults his wishes, but also his fears, in preference to those of any other more distant entity. If he feels danger or distrust from any other human being, he feels no scruple, at putting him out of the way.

In all this he can only be prevented by the superior might of others, which make him apprehend to experience the fate destined for them, from themselves.

It is true, the rights he asserts over others, if stronger, he in his turn acknowledges in them over himself, if weaker. He is not surprised at their attempts to subdue him; nor does he complain of injustice if they succeed. He only tries to guard against their wiles, as he would against

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the murderous fangs of a wild beast. If he is the stronger he generally kills them outright, in order to guard against their later resenting any lesser offence. Kills them at once, lest he be annihilated by them.

Thus far in a state of nature, not only between brutes but between human beings, superior force alone prevails, and fear lays the law.

The state of nature is a state which, when we have emerged from it, is called a state of theft, rapine, robbery, rape, violence, murder, treachery, and distrust, not only among brutes but among human beings: and the more fierce and destructive among these latter than the former, as they feel desires of enjoyment and of property more unbounded, more extensive than brutes; and have, to gratify these, superior intellectual means—superior imaginations, ingenuity, diffidence, and distrust.

Many brutes not carnivorous remain entirely inoffensive and peaceable, even among brutes of very different species. Even the most savage and ravenous, respect their own species, and, except when famished, stand in awe of man.

Man, alone, in consequence of his desire of property, independent of enjoyment, threatens

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with constant danger other men. Man has naturally many enemies, but none worse than other men: of none he has more to fear.

No wonder he should try to extricate himself from this state of constant insecurity, constant apprehension.

With brutes he has no means of escape by an agreement. They cannot understand any compact. The lion and the tiger will ever continue, while hungry, to fall upon him.

Even man, the most civilised, and who considers himself most as under certain obligations to those individuals and nations with whom he has made a compact, still considers himself as owing no duties to those with whom he stands in a state of nature, with whom he has made no compact. He wrests from them their country; he murders them; he strips them of their possessions; he reduces them to slavery. It is only lately that the idea of certain moral obligations he owes his Maker, has made him fancy he owes some even to those of his fellow, creatures to whom he is not bound by express ties of fear or interest.

But very early, the man, in fear of being attacked by another man, proposed to a third individual, having no object in aggressing him, to assist him against that first, to be his ally, on

promise to assist him in the same way if he was attacked; and the third, actuated by fears similar to those of the second, listened to the proposal, and closed with the proposal. Thus was fear the first immediate cause of the civil compact.

Individuals, combining their powers, physical and intellectual, acquired greater means of resisting single or fewer aggressors: felt less fear and gained more security.

Thus far, however, the compact was merely defensive; but man soon found that he might not only increase his security, but his enjoyments, by adding to his own labour and toil that of others. He bribed others to increase his enjoyments by their labour with the offer of an adequate return. The contract was extended, and made to comprehend conditions more numerous and more varied.

To those who formerly made it others may in the course of time accrue, who, conscious of its advantages, and glad to partake of these, tacitly accede to them; and these latter in most states form the bulk of the population.

They are treated like those with whom it was found expedient first expressly to make the compact.

But among the number of inhabitants by de-

grees born in or who flock to a country, there will always be found a few who, not having expressly acceded to the contract for the good of all, or from a change of circumstances no longer finding their individual advantage in adhering to it, do not choose to consider themselves bound by its terms, and wish to rescind these, or at least personally to withdraw from its conditions.

According to nature they have an entire right so to do—but at their peril; and as long as society collectively preserves the rights each of its members had before distinctly and separately, it has collectively the right which it possessed before any compact was made, of defending itself against, and of punishing any member, who secedes from the compact, and who threatens its security and welfare.

Indeed, members of a society, in a case in which they are prevented from availing themselves of the assistance of their fellow associates, are entitled again singly to step into all the rights of nature, of which they had conditionally ceded a few, and to defend themselves with all their might and power against any aggression, or even to commence any aggression to their advantage. A man in a boat at sea, threatened to be shipwrecked by the weight of another man

in the same boat, may, without guilt, toss that other overboard.

It will not signify that an individual has not expressly agreed to the penalties others make him pay for injuring or even threatening them. He was liable to these penalties before he made any contract; and his fellow creatures again have a right to enforce these penalties after he has receded from it.

As long as in a country the majority of the population finds an interest in adhering to the contract, and in maintaining its terms against those that secede from it, these latter must take the consequences of their secession, and have no right to complain, even though their entire annihilation should be the result. All they may do is to revert to the rights of nature, and defend their life, if they can, against the majority of those interested to take it.

However, as long as the majority of a nation find the terms of the contract beneficial, they will maintain it even against the few that have an interest to rescind it; and as soon as the majority themselves find an interest to rescind or to alter it, nothing can long prevent the thing being done, expressly or tacitly: nor can it be desirable to prevent it.

At first people only agreed together each to

desist from what could be noxious to others: what could injure the lives, the property, the liberty they already possessed: but, meeting for this purpose, and finding what more might benefit each in particular, but could not by each individually be acquired without the assistance and co-operation of others, each also would try to obtain from others what was for his advantage, by engaging him to do what was for their good. The contract, from being merely negative, would become positive. From only having agreed on common defence, people would sometimes agree on common attack. They would establish a concert in their predatory expeditions: they would plan colonizations in common: they would, in addition to common and public punishments for what are called offences, crimes, institute common and public rewards for what were considered as services and virtues. They would from part of their individual means form a common stock, in order individually to reap from the same a benefit superior to the sacrifice it cost them: they would frame institutions and erect works for the good of the community at large. Highways and bridges for the public convenience would be raised. Fortifications for the public security would be constructed.

Where a number of people assemble to agree upon, and to do all these things in common, they compose a community, a state. Where they

see in common or by deputy to their being duly performed, they have a government. Governments are only framed to execute the resolutions and rules first made by individuals, for the purpose of inducing them to abstain from acts injurious, and to perform acts beneficial to each other.

In all communities the defence not only of each individual in particular, but that of the community at large, was first the business of all—all men alike were first civilians in peace, and soldiers during war. By degrees, as the community extended; as the number of its members increased; as their avocations, their faculties, their habits, and their propensities became more diversified, the burden of defending others became more grievous to some part of the community than to another. The former then found it convenient to itself, and agreeable to that other, to share with that other part of the result of its peaceful labours, in consideration of that other singly taking upon itself all the toils and dangers of general defence. Thus arose a distinction between citizens and soldiers—between men only addicted to the arts of production, and between those engaged only in the arts of defence, and, for the purpose of assisting that defence, in the destruction of the objects by other men possessed: thus arose the stipend by the citizen paid to the soldier.

The first governments were always of a po-

pular sort. Framed on the model of that which in each single family its common parent and chief asserts over the junior and less experienced members of the family, wherever, in a small territory, the few chiefs of different families wanted from each other some renunciation of part of their natural rights over the other,—some promise of services to be rendered on charge of reciprocity,—they all met for the purpose of proposing the measure; of having it agreed to, if agreeable; and thenceforth of having it passed in law, and executed. Each, in turns, was legislator, and became subject to the laws framed: each, in turns, was ruler and ruled.

But where over more extended regions spread a population more numerous and more dense; where the individuals forming together a single community, a single government, became more distant, more diversified in their faculties, their means, and their pursuits; where the concurrence of all to public measures began to require in many persons a greater sacrifice of their individual interests and pursuits than they were willing to submit to, those that lived furthest from the place of meeting, that had most wants of their own to attend to, and least capacity and convenience for attending with success and discernment to the wants of others,—who by attending to those of others must lose most in proportion to what they gained,—proposed to other men nearer, richer, losing less by the task,

and in whose intentions, faculties, and means, the rest more confided, to renounce their private avocations, to represent them, and to rule the whole community in their name, on condition of rendering it worth their while, and making them not only amends for what they gave up, but allowing them out of their own means a superior consideration, in property, in power, in authority, and in deference. Salaries were held out to them, and by the promise of superior profit and authority they were induced to undertake the grievous task, the heavy burden, the awful responsibility. Thus governments, according to the size of the country and number and distance of the inhabitants, from democratic grew aristocratic, oligarchic, monarchic, and despotic. The line between the rulers and the ruled became more distinctly drawn: the former increased, and the latter became fewer. Often, in a country very extensive and very straggling, the government remained democratic in its centre and became despotic at its outskirts. Sometimes, but more rarely, the reverse was the case.

As long as the rulers are at once most well-meaning and most intelligent, the government most despotic is the best. That of a single despot is then superior to all others. He will, and he can, do most good: he is most like God upon earth. No partial interest of a few individuals can control him in his measures for the good of all.

But, like all other individuals, rulers them-

selves are still only individuals, and individuals not always pure in all their thoughts and actions. They are subject to prefer the attainment of their individual desires and whims to that of the general good; they are liable to wish that the government instituted for the advantage of the many may be converted into a means of oppressing the many for the superior welfare of their few individuals. While, however, every man was not only a citizen but a soldier, such evil intentions in the sovereign could hardly be brought to bear. Every man, practised to defend his rights, would be able to defend these even against his own ruler, when seeking to infringe them. But when soldiers were made to form a separate class; when they became more trained to violence, and the other citizens, more prone to submission; when it became easier, by the promise of reward, to detach these soldiers from the interest of the many that were ruled, and to gain them over to the views of the few that ruled, the case became different. Institutions established for the advantage, the defence, and the security of the many, often were turned into institutions for the advantage, the defence, and the security of a few, at the expense of the many: a few became not gods, but devils, and the many became their victims.

CHAPTER XII.

Liberty in man over his own actions; power in him over the actions of others: subjection to the actions of other individuals.

WHATEVER we may think of the existence or non-existence of a liberty of will, there is a liberty of action: that is, there cannot be denied to exist, while we wish a certain thing, and while we possess the means necessary to obtain that thing, the liberty of using these means requisite for that purpose.

This liberty is exerted by each individual, while he remains in a state of nature, to its most unlimited extent. In that state of nature each man uses his means and liberty to attain whatever he wishes for: no matter in whose hands he finds it. If that thing be in the hands of another, from whom he can wrest it, he adds to that liberty the power he possesses to take it from that other. Liberty to a certain degree is inseparable from power. Its exertion, naturally, at a certain pitch runs into that of power, and consequently into that of rendering others subject to that power.

But as, in that state of nature, each other in-

dividual has the same liberty of action with the first, and, when the thing he wishes for, is in the hands of another over whom he has power, equally makes his exercise of liberty degenerate into exercise of that power over the other, for the purpose of obtaining the thing wanted, the liberty of some is soon made to give way, and to be exchanged in them for subjection and for slavery.

In a state of nature thus man, as at one moment he feels less restraint upon his liberty, as he soon pushes it to the utmost extremes of licence and tyranny over others, also is liable soon to have it pass over to the extremes of servitude and subjection.

It is in vain in this world for all its individuals alike to hope ever to combine both the utmost individual liberty of actions, the utmost power over the actions of others, and the utmost enjoyment. As some become more free, more powerful, less checked in their actions, others must become in their behaviour more subject, more restrained, more checked.

Man soon felt this: soon felt that neither the excess of liberty or licence, nor the excess of servitude, contributed to his happiness. He voluntarily restrained his liberty of action, his power over the actions of others, in order that others might restrain their liberty of action, their power over his actions: his subjection and servitude to them. In order that by abstaining

from extreme licence he might be secured from extreme servitude, he renounced that licence which on the whole could do him less good than harm, procure him less happiness than misery, for that modified liberty which could do him more good and less harm; which could leave him more time and means for rational enjoyment, and could save him more retaliation of evil, more misery.

And the more each individual gives up of his extreme liberty, his licence to rule the actions of other men, his power over these other men, and, with that power, the trouble, the watchfulness, the unpleasant consequence which its exertion requires or produces, the more he thereby gains the security of not having his own actions ruled by others, the more he trusts the power of ruling into the hands of fewer individuals, the more, as long as the individuals intrusted with that power exercise it with impartiality for the good of all, he finds its exercise fall lightly upon him individually, and the more it leaves him at leisure for individual enjoyment.

I say, as long as the individuals intrusted with the power of ruling others exercise it with impartiality, and for the good of all; for certainly, as soon as, from lack of discernment or from want of good intentions, the few that possess power over the many use it for the oppression of the many, the fewer they are, and the greater may become the weight of that oppression; the

less they are in their oppression even checked by each other.

Some ancient states of Greece entertained the chimæra, that in a state the population at large could combine, with the utmost liberty the utmost power, and the utmost happiness. After having arrived, after many trials, at instituting regal power, they again abolished the rule of a single monarch, and re-established democracy.

At least they re-established democracy to a certain point. They continued, it is true, to rule with a rod of iron their slaves. They felt that even small as were their commonwealths, few as were their inhabitants, there was not room for all alike to enjoy the sort of liberty they aimed at: that, for a part of the people to enjoy great power, another part must experience great subjection. For one freeman who was a despot at home, there were allowed to be ten slaves without house or home, deprived of friends, family, relations, property; who had nothing to offer to the extreme licence of others, but the contrast of the most abject slavery.

Nay, even then they found that the extreme liberty of the few that remained free, required so much room and latitude, that the moment the number of freemen increased beyond a certain pitch, a part of the privileged number were themselves by the impatience of the remainder, like the young swarm of a hive, driven from house and home, forced to embark, and made to

seek elsewhere, in some uninhabited country or among strangers, a place of refuge, where they settled, established colonies, and sought, by wresting from the natives what belonged to them, that liberty which they could no longer exercise at home. At least they flattered themselves that thus equality of rights and of power would ensure to the limited number that remained behind, enjoyment and happiness.

What happened? Even these latter only exchanged the lighter subjection of the multitude to one monarch, for the more painful servitude of each individual to the will of each other individual in turns. Instead of obeying one king, whose pressure on the many was lightened by the distance from whence it came, by the divided weight with which it fell on all, by its being divested of the sting of caprice, or ill-will, or rancour, or jealousy, or envy, each individual was made to smart under the lash of innumerable tyrants, of endless informers, of a mob actuated by every feeling of spite, of envy, of ill-will, of ignorance and of caprice: instead of the most exalted, the most enlightened, the most interested in the welfare of all ruling the mob, the most ignorant, most prejudiced, most ignorant of the mob had the greatest sway. Instead of the multitude being subject to the rule of those who had most will and most interest to govern well, these latter became the slaves of the former. Aristides was condemned to exile

because a cobbler grew tired of hearing him pre-eminently called the just. Nay, what was called democracy, only degenerated into a mere struggle between two opposite factions, each as oppressive, as miserable, as unhappy as the other.

CHAPTER XIII.

Slavery.

The man of mere nature who claims, who asserts a right over the lives, the property, a fortiori asserts a right over the liberties, of whomever he can make his slave. In a state of nature superior strength alone decides who shall rule, and who shall obey. Like the beast, the weaker human being is made to bear the strong man's burden. Even highly cultivated nations of ancient times still, wherever they had not for mutual advantage entered with each other into any agreement to the contrary, like the Tartars of the present day, made predatory expeditions against their neighbours, deprived them of house and home, and led them into captivity on foreign shores, merely to obtain domestic slaves. The noblest youths, the highest born dames of Troy had to endure all the degradation and the sufferings of servitude, under the roof and in the fields of a Grecian clown. Only by degrees did men of more humanity, even without the restraint of express compacts, reduce the right of making slaves; first only continue to exert that right over nations ruder and possessed of feelings less

acute than their own: and lastly, abandon it with regard to all who like themselves bore the human form: and it is said, that those must be very dull in body and in mind—very low in the scale of humanity—from whom services more valuable cannot be obtained by good-will, by an adequate return, than can be extracted by mere stripes and compulsion. Even a horse, treated with gentleness—spared the whip and the spur—in general becomes more tractable, more docile.

CHAPTER XIV.

Arts of imitation, modelling, moulding, chasing, carving, painting, pantomime and the drama.

People wonder that a comparatively early nation—the Greeks—should have carried the imitative arts—those arts that first address the ear and eye, and that next, through these organs of the external sense, speak to the mind within—the arts of modelling, carving, painting, poetry, pantomime and the drama—to so much greater perfection than those nations that flourished later, and surpassed them in science, since have done: that the works of the ancient Greeks in the imitative arts should to this day serve to the most refined modern nations as models, which their utmost efforts cannot equal.

This is partly owing, no doubt, to nature having supplied them with the finest models: but moreover and especially, because, being themselves a nation by nature highly gifted, and having made great strides in most of the arts not only of utility but of pleasure; not only of necessity but of luxury: having distinguished themselves as warriors, as statesmen, as philosophers; having acquired extraordinary proficiency in all bodily

prowess, and in all mental accomplishments; having been engaged in transactions private and public of the greatest moment; having conceived a system of gods and rulers very exalted whom they felt bound to worship; having signalized themselves by every species of talent and merit; having from vanity, from pride and from policy, felt desirous of showing the greatest sense and gratitude for past services to the community, and of affording the greatest excitement to future benefits conferred on that community, by giving them the greatest notoriety, and retaining of them the most lasting records and monuments, before the art of writing was invented, or at least was in common use, they could only attain these ends through the medium of the various imitative arts: because the works of these arts, consequently, serving as archives and monuments both of private agreements and public treaties—as documents alike of private deserts and of public claims—were regarded as of the highest consequence to the welfare of individuals, and of the state at large; because, having for their object the conveyance of the most important intelligence in the clearest and most direct manner, they not only on the one hand aimed at expressing what it was essential, and the very purpose of the work of art to convey to the sense and mind, in the most clear, accurate, direct, straightforward

and faithful manner, but on the other hand, at keeping it carefully disencumbered of whatever, though in itself accurate and faithful in as far as imitation, but only introduced for the mere adventitious purpose of pleasing the eye and mind, was at best apt to bewilder, to divert the attention from the principal object proposed, to destroy its unity and simplicity, and easily became meretricious; because, as the truth and merit of the works of imitative art were thus of the highest consequence to the welfare, the glory, of the community; the merit, the morals, the rank, the estimation, as well as the talents of their professors were of equal importance; and because, in a country where every man consequently became an excellent judge, and an ardent patron of their productions, those who were intrusted with their performance, and executed their task worthily, were looked upon by others, and looked upon themselves, as characters entitled to the highest consideration, and spared no pains to attain the highest excellence. Thence it is that the Greeks became the first painters, sculptors, musicians, mimics and dramatists in the world. Thence, finding that the different features of beauty were only each in their highest perfection found in different real individuals, they thought of collecting their representation in imitative individuals, which thus singly surpassed in perfection any real ones that had existed before.

A strong impulse given will often continue to act, and even with greater effect, for some time after the cause of the impelling force has ceased. A fire will burn brighter, when the fuel that fed it is nearer being consumed.

Perhaps the vivifying principle had already begun to flag when Phidias produced his Jupiter, and Polyctetes his Venus: but finally, by the prevalence of the art of writing, the imitative arts, no longer remaining arts of direct necessity, or even of the highest utility, the highest consequence to the state, and to those intrusted with its most important concerns, but becoming arts of mere beauty, ornament, pastime and pleasure to the idle and the frivolous,—losing their severity, their simplicity and their modesty,—no longer serving as instruments to the most noble purposes, no longer exercised with the most religious, most patriotic, and most exulting feelings, fell from their high estate, and have never since recovered it.

CHAPTER XV.

First auxiliary and representative art, that of oral or spoken language.

People often blame others for speaking before they think. Literally the thing is impossible. We must think to a certain degree, we must have certain ideas concerning things before we can be prompted to express these ideas in words, in language; but we may have concerning things ideas, and we may use words, we may employ language, more confused, more unconnected, or more clear and more connected; and when people say that others speak wholly without thought, they must be understood to mean, with very little thought, before they utter that thought in speech.

Indeed people who have a great exuberance of animal spirits, which they want to vent, often do so. Before their ideas are so defined, so digested, so connected as to be worth communicating, they will hastily express them by short detached sentences, which individually have already in themselves some meaning, but of which

the meaning is not yet widely and distantly connected with that of the remainder.

Even a philosopher, and a man of profound thought, Condillac, has said that ideas could not be connected without the use of words; that consequently words preceded the ideas representing them. This assertion, however, is as little true as the former one just controverted. Many external objects and modifications are connected before the combination of the ideas they singly raise in the mind are so; and those ideas concerning them are again connected before they suggest the words expressive of that connexion. If men had no previous idea of such connexion, they would not want to express it, or find words so to do.

It is true, however, that after we have to different external objects, and to different ideas concerning these external objects, attached certain words, certain signs representing them, these very signs, these very words imprinted on the memory, tacitly recollected, serve to recall these ideas to the mind, react upon them, and give them more precision, more clearness, more order and more connexion, before they are uttered, than they had in the mind before words were used to express them; that many people speak under their breath to assist them in thinking, and that many speak aloud, even where they have no one to listen.

The general idea is, that as there was only thought to be one single primeval human pair, so there originally only was one single primeval artificial and conventional language given that pair by miracle, and by that pair transmitted to, and understood by all its descendants, till by a second miracle a part of these descendants again suddenly forgot all they had been taught, found it unintelligible, and soon were forced to invent new and different languages.

But in the first place it appears probable that there already from the first were many races, widely dispersed over the globe, according to the different climates and situations in which they were produced differently organized, and each of which already wanted, and thus invented an artificial and a conventional language of some sort, suitable to its own organization, and consequently different from that of others; and this is conformable to the whole course of nature.

The higher brutes already by certain internal emotions are made in certain external muscles to produce movements, in their turn again productive of sounds and cries, by which these emotions are vented and expressed. Each species of animal, according to its different organization, has a different mode of expressing similar emotions.

But all these emotions of brutes, still only alike proceeding from mere concrete wishes or fears

in their minds, still suggest to them no idea of expressing these feelings by artificial and conventional sounds of an articulate sort. Their natural cries suffice to make them understood.

Man himself also still, like the brute, begins by only having his concrete feelings of content and suffering, desire and apprehension, which, like the brute, he vents and expresses by inarticulate sounds of laughter, weeping, sobbing, sighing, growling, groaning and grunting.

But man, moreover, alone has ideas, desires and repugnances of an abstract nature, to obtain the gratification of which he wants the concurrence of other individuals of his species, which his mere natural cries cannot render intelligible to them, and which he nevertheless must wish to communicate, and to render comprehensible to them.

Every man then, beginning as much of the action he wishes to perform as he can singly, by using significant gesture and pantomime, by accompanying the same by the particular sounds and cries which his emotions and eagerness would prompt, and by thus always using the same sounds when the same desires agitated him, would at last by the mere uttering of these sounds, these cries, render his desires, his intentions intelligible, even without the corresponding actions, gestures and pantomime, and thus would, to cries uttered without intention, be added sounds uttered with the express in-

tention of having them understood, and which are called words. Particular sounds, thus rendered more distinct and articulate by art, on the one side uttered for particular purposes, and on the other side understood as meaning those peculiar purposes, would thus become the conventional signs for representing them, and between certain individuals a certain artificial and conventional oral and articulate language would thus be by degrees established. In each different race, according as its natural organization, and the natural cries prompted by the same differed, this artificial and conventional language, first originating in these natural sounds, and founded on their base, would also be different. But in individuals of the same race and similarly organized, the earliest artificial and conventional sounds, arising from and intended to express wants and ideas very simple, and very little removed from the mere concrete feelings still vented by mere cries, would still remain confined to those simple combinations of vowels and consonants, which remain monosyllabic, or by eagerness only are repeated, such as those of mama, baba, papa, dada, tata, caca, which still are under various simple significations used by and to infants of all the higher races, similarly organized.

Thus was, probably prior to any other art, and first only for the purpose of expressing the mere feelings of nature more distinctly and pointedly,

among every race of human individuals, invented an artificial and conventional articulate language, conformable to the peculiar organization of the race, and undoubtedly in some races more distinctly articulated than in others; which afterwards became the auxiliary and the representative, not only of the feelings of nature, but of the inventions of every other art and science; and which with the discoveries of new modifications of nature, and with new inventions of art, had its signs representative of these increased and developed.

That in each race of human beings, different and distinct from others in its organization, the language was also first distinct and different, appears proved by those races in Asia, Africa and America, which still remain nearest a state of mere nature—which still have made least progress in civilization—having not only the fewest words, the most restricted language, but, however few be the individuals of which these tribes are composed, and however near to them may be the other tribes different from their own, still each having a language most different from that of the neighbouring tribe, and most unintelligible to that neighbouring tribe.

Of these men, still possessed only of inferior organizations, some have languages resembling the sibilations of a serpent, others, words resembling the croakings of a frog, others, sounds

similar to the cacklings of a goose, or the chatterings of a monkey. Even higher nations, and whose languages have acquired a greater similarity as to form, still preserve in them the distinct national thorough base of a peculiar lisp or brogue, nasal or guttural sound, which preceded the assimilation of their artificial languages to each other, and which, proceeding from their natural organization, continues to predominate. Such differences of tone and terminations we find in the languages still spoken by the Piedmontese, Genoese, Milanese, Venetians, Lombards, Tuscans, Romans, and Neapolitans one way, and by the Provençals, Spaniards and Portuguese the other way; though all alike present idioms of that original Italian, Gallic or Celtic languages, of which the Latin itself was only a later, more partial and more shortlived remodification, remixed with the loftier Greek.

Each different race, first by new wants, new desires, new observations on nature, and new inventions of art of its own, made to increase and to vary its own peculiar language, as it more extended and came more in contact with other races, also, by borrowing from these other races more things and more ideas, and by lending to these other races more things and more ideas of their own, with these adopted, gave and exchanged, more of the terms representing them, and by this means the language of each indi-

vidually, originally most different from that of the others, and most poor, though its base might remain different, became in its later superstructure richer, more copious and more similar to that of the other; in the same way that stuffs, originally in their texture homely but different, may by subsequent similarity of embroidery have their difference glossed over, and be made to become at once more rich and more resembling each other. Invasion and conquest, by spreading certain of these languages, while it subdued and extirpated others, would still increase this similarity, and by degrees a few languages would preponderate.

Thus it was that already in early times certain languages began to prevail over the rest; that the ancient pahlavi of Persia has produced the similarities to it, found in the more eastern Sanscrit, the more northern Teutonic, and the more western Celtic. Thus, of the Celtic, Keltick, Gallic, or Wallick stock, the different ramifications have again composed the similarities found in the Greek, Roman, Italian romance, French, Spanish and Portuguese languages, in the langue d'oc and the langue d'oeil, in the Walloon of the Netherlands and Germany, in the Welsh of Wales and of Cornwall, in the British of Britany, both on the continental and on the insular side of the British channel, and in the Gallic or Gaelic of Scotland and of Ireland; throughout

all the intermediate regions, beginning from Galatia in Asia Minor, to Galicia in Spain, and the Gallic regions of England, Scotland and Ireland. Afterwards the idiom of the Celtic or Gallic races was again in most parts of Britain, and in many parts of Gaul, superseded by that of the Teutones, called in England, from the more particular denomination of the Teutonic race which conquered the country, English, and called in Gaul, from the more peculiar political organization of the Teutonic tribes by which the region was subdued, Frank or François, the name which even a circle in Germany still bears.

Thus the idioms of the Teutonic races have not only prevailed in Germany, in Sweden, in Norway and in Denmark; have not only with the ancient Celtic, and with the more modern French, been engrafted on the original tongue of Great Britain; but have with the Gothic tribes made considerable inroads in parts of Spain.

And thus, finally, did the Slavonic languages of Russia, Poland, Bohemia, Slavonia, Illyria and Dalmatia, from the White sea to the Black, almost become the same.

Various languages which first have their infancy, their growth, their development, their state of flourishing, of maturity and of fructification, also again, with the races that spoke them, and the other arts by these nations introduced and cultivated, have their decline and

their death. Many, even after their spirit has evaporated, still preserve their outward form and construction. After a language was disused among the nation at large, it still often by the priesthood, for peculiar purposes of a religious nature, which they wished to preserve from becoming too familiar, or by the learned, in view of the excellencies of the works embodied in it, continued to be occasionally used, though but imperfectly understood; and sometimes it became, like the Syriac, wholly unintelligible. Such is now partly the case with the ancient Greek, and even with the Latin, by the pride of the Roman patricians, in order to possess a language different from, and more lofty than that of the plebeians, artificially on its ruder Italian basis raised, and dignified by a Greek embroidery; but which has, except in the works of ancient authors, and in the ritual of the Roman church, again fallen into disuse.

Every language would at first only express the more obvious physical phenomena. At first, when it was wanted to express metaphysical modifications, it was obliged to borrow its terms from those employed to stand for the former. Thus in early works the Almighty is made to ride on the storm; his features are ruffled by wrath; he displays the movements, has the feelings, and performs the actions of man. By degrees people would form distinct expressions for

intellectual phenomena, and then the former ones, when they continued to be thus applied, received the name of allegorical, figurative and symbolical; and by giving a double sense to ideas, and by making the same words express a twofold meaning, were supposed, from originally being a symptom of poverty, to become a sign of wealth, and were allowed to enrich the language, and to render it ornamental.

CHAPTER XVI.

Language representing things no longer to the ear, but, at second hand, to the eye; no longer spoken, but written.

Sounds rapidly produced as rapidly evanesce. Those representations of ideas which they alone afford, unless caught up while dropping from the lips by the attentive listener, reach not the mind of the latter. Those uttered by a single individual can only be made to reach a confined circle of other individuals, immediately surrounding that first. Through the medium of these they must again be repeated, before they can be transmitted through further time and space to circles wider and more numerous, and in thus being diffused they risk having not only their spirit evaporated, but their very meaning perverted in the journey. Never can we be sure that words transmitted through many lips, ideas received at a distance from their original source, still remain a faithful representation of those which their first authors are said to have uttered. After a certain time and space, at a certain distance from their first origin, and

through a certain number of intervening links, all oral tradition, from errors, from ignorance, from prejudice, from infidelity of the transmitters, becomes doubtful. A single word misquoted; a single change of an affirmative into a negative; of a question into an answer: a single mistake, a single want of memory, a single forgetfulness, in any one of the individuals that form the intervening links; a single link in the long chain of successive vouchers, necessary to a tradition reaching from remote times and places, less firm, less solid, less to be depended upon than the remainder, will infirm the evidence: and thus of many of the greatest events of early periods the memory has been lost, or has been burthened by accounts so evidently contradictory and fabulous, as to have become entirely unworthy of credence.

Nor are these the only drawbacks upon oral tradition. Whatever through this fallacious channel is communicated, must by its first author be divulged to all the intermediate individuals, through means of which alone he can transmit the intelligence to the persons and places more distant, for whom it is intended. The lowest menial who carries a royal mandate orally delivered, and to the most distant satrap, on the most important subject, must from the very outset be entrusted with its whole secret. It is entirely at his mercy. His indiscretion may be as

dangerous as his forgetfulness. No intelligence can, during any part of the time and space intermediate between its giving by one person, and its reception by another distant person, remain concealed and undivulged: can rest a mystery, till it reaches the place for which it is expressly destined.

It thus soon was felt desirable to invent, in addition to the mode of communicating ideas and wishes through sounds widely proclaimed, and yet fugitive and uncertain, some mode of conveying intelligence less loud and yet more lasting.

The first method that occurred was through means of imitations of things wanted, visible to the eye, such as painting and sculpture can afford; and the production of such symbolic representations were no doubt long and in many countries among the first purposes of necessity and utility, which promoted the cultivation of the imitative arts. Of this mode of expressing thoughts we still find remains on the monuments, and on the papyri, of the ancient Egyptians, on the tablets of the ancient Mexicans, and in the manuscript characters of the Chinese.

These symbolic characters having no reference to the sounds of spoken words, but directly imitating the forms represented by these words, may remain similar, even where the spoken language is different; and this, in fact, happens to be the

case in many provinces of China, where the conventional and representative spoken languages are different, but where the unconventional and imitative written language is the same.

But soon it was found that mere symbolic representations were long and tedious in the production, and were, after all, when produced inadequate in their power of conveying a definite meaning: that they are singly able only to represent even of physical modifications the mere stationary forms, not the movements, not the changes: that they can singly only represent these very forms as they are in a single individual point of time, not as they become in their successive developments in time and in space: above all, that they have no power whatever of representing modifications merely intellectual, destitute of visible form: no wills, no desires, no aversions, no intentions, no plans, except by still adding to them the auxiliary and circuitous means of oral traditions, which must even then, after a time, leave their meaning doubtful, or render it a perfect riddle.

Of the symbolical signs of the ancient Egyptians, the sense is entirely lost, and of the complex characters of the Chinese, the number is so multiplied, that a perfect knowledge of them requires the labour of a man's life. In China, a man who knows his alphabet is really a man of letters.

At last it occurred, firstly, it is said, to the Phœnicians, that the simplest elements of the various sounds, which are combined in the various words that represent things, and the ideas concerning them, to the ear, and which in themselves are but few, and derive their variety and number only from their combination, might themselves, in their turn, be by visible signs as few and simple, readily again at second-hand represented to the eye. This was done, and thus was invented a visible alphabet. Thus were formed written and visible letters and words; and these words fulfilled all the purposes of durability in time, transmissibility in space, and others, which mere spoken words wanted. Nay the same written letters, the same alphabet, might, of languages very different, but whose elementary sounds were the same, represent the words. Such were the advantages of writing, that in most countries it caused symbolic characters to be abandoned. By the Egyptian priesthood, their use was only retained under the name of hieroglyphics, or sacred writing, to embody facts, of which they wished as much to withhold the knowledge from the vulgar, as among themselves to retain and perpetuate the memory.

First, writing was only from beginning to end executed by hand: of each collection of ideas, each single manuscript relation still, from be-

ginning to end, required a distinct operation, and writing to a certain degree, in the slowness of the operation, and in the small number of those that could simultaneously, by a single written copy of a work, gain the communication of the ideas it contained, lost as much one way as it gained the other by the durability of these copies. Later, much later, the invention of printing, and still later that of stereotype, by enabling the embodying of ideas in visible words to be performed with greater rapidity, have enabled ideas to be transmitted and diffused almost with the speed of lightning.

CHAPTER XVII.

Other modes of representation, arithmetic, algebra, money, coin, drafts, bank-notes, &c.

We have seen the invention of signs representative of external things in general, and of the ideas concerning such, called oral language. We have seen spoken language again in its turn represented by written language. To these signs the want of representing numbers in particular, by figures still more concise and clear even than those of words, caused the addition of numerical characters; and the want of representing quantities, by other signs still more concise and clear than those of words, caused the addition of algebraic signs.

As with the increase and diffusion of individuals, the productions of nature by these individuals possessed, the objects of art by these produced, the labour wanted for the production of new objects of art, and the exchanges and barter of such objects and such labour as were by each wanted, and by each offered for an adequate consideration, also increased in number, variety,

diffusion and distance from each other; as the individuals that wanted goods and services from others, and those from whom others wanted goods and services, were more numerous, more distant and more different; as consequently more time, more space, more movement, more labour, more division and subdivision and adjustment of articles were required; more loss even, more deterioration, more decay of commodities was incurred, before each person could be satisfied, people soon began to want for the value of each production of nature or art, and of the labour of producing each, a representative sign, which might more easily and rapidly be transferred, might be preserved while the goods of which it was agreed to represent the value were not on the spot, or not wanted, and which, at any time and in any place where these goods were present and were wanted, might again at second hand in quantities proportionate to their value be for them exchanged.

And in different countries different objects and substances were agreed upon, and made to receive this power of representing the value of other productions, and of labour; and were in the capacity of possessing this power called money.

In some regions the character of money was given to certain shells called cowries, scarce

enough to require some labour to find them, and so small as to be made easily, by increasing their numbers, to represent different values.

But in other countries certain metals more rare, more ductile, more dividable in the smallest aggregates, and more easily collected in the largest masses—consequently more admitting of being in their quantities exactly proportioned to the value of the commodity they were made to represent—at the same time more imperishable,—were rendered the representative sign,—the circulating medium—that was to be admitted as representing the value of all other substances, goods and labour. First pieces of metal were only exchanged against goods according to their quantity and weight: but where individuals had in their rulers sufficient confidence, they trusted in the value which the coin of the sovereign certified the different pieces of metal to bear, and goods and labour were thenceforth valued according to the money they would fetch, and were no longer directly exchanged, but bought and sold: or, if the bargain was for a definite term, let and hired. Yet, as certain articles, or as the money that represents them are more abundant or scarce, as people have more or less of certain goods, in proportion to others who want them, and as these other people can afford to give more or less money for these goods, will different goods rise or fall in price.

When money can only conveniently be procured at periods and in places more distant, but can ultimately be procured, in order to gain time and to save space, it has been contrived again, in the meanwhile, and pro tempore, to represent this money by drafts, by checks, by bank-notes, which however are only considered as having a transient value, and that only, where the money, or the money's worth, are regarded as ultimately capable and sure to come forth.

CHAPTER XVIII.

Representative government.—Control over the representants.

Each community of which the various members have, by a compact express or tacit with each other—by a proclaimed agreement, or by the silent yielding of each individually to the common will manifested by the remainder—consented that each should no longer individually directly and in person be held to do all that is agreed upon for the common good and welfare,—each community of which the government is no longer wholly and purely democratic; of which each member no longer, in person meeting all the others in a general assembly, is singly in his turn ruler and ruled; of which the members, in view of their numbers, their distance from each other, of the extent and nature of the country they inhabit, the difficulty they find in all meeting, the greater loss some individually experience than others from all concurring alike to rule and be ruled, or of other motives, consent that certain measures required for the general public good and

welfare should be decreed and executed only through the medium of a smaller number of individuals, chosen by and deputed from the mass of the community at large to represent the rest, and to attend to its benefit—whether the community be, in respect of the measures beneficial to all, ruled in a patriarchal form by the head of the family or by the chief of the tribe, whether it has a federal form of government, in which the interests and measures of smaller masses of the population, and smaller divisions of the state, are separately, in different localities more proximate, by men better informed of and more directly concerned in their peculiar individual interests, more immediately directed, before measures more generally interesting the whole are at a greater distance transacted and decreed by a more general senate of deputies from all those lesser circles, or whether it has only a single general assembly of delegates from all the different parts of the commonwealth, in which all that concerns its utmost extremities and divisions is directly transacted: whether the deputies have from their constituents received less or greater authority and power jointly to rule them; and whether this power be delegated to them for a shorter or for a longer period, or indefinitely; whether the deputies from each portion of the community or state be many, or few, or only a single individual; whether they be called by the

name of deputy, representative officer, minister, lieutenant, governor, satrap, pacha, protector, president, prince, king, monarch, dictator, emperor or despot, is already a community in some degree subject to a representative government. The fountain head of all authority, which lies originally in the assembly and mass of all those that have concurred in a compact to defend and protect each other, and to concert together measures for common security, defence and advantage, has already in that community to a certain degree expressly or tacitly delegated the exercise of a certain portion of that authority to—has already caused itself to be in the exercise thereof represented by—a smaller portion of its members: and the smaller the representative portion is in its proportion to the whole, and the greater the power delegated to that smaller portion, the more eminently the government becomes representative.

The difference only lies in the number of those, to whom the power and authority, inherent in the general mass, has been delegated; in the degree and sort of authority given them over the remainder, in the period for which this power is lent them, and in the means afforded them of exerting and of maintaining it.

Where the community has established a distinct standing army for its defence and protection, and of that standing army has confided

the command to its ruler, he still only legitimately exercises that command in his character as representative of the nation at large; and is supposed to do so only for the good, the protection, the defence of the nation.

States too small in proportion to other neighbouring states to be enabled to balance, to resist the power of these latter, while separate from them, and thus risking by that separation to be sacrificed to the individual advantage of these latter greater states, must gain by being united with them under one head, interested in balancing and forwarding the common good of all, and able from his power, and from the size of his dominions, more extensively to promote that good. The individual vanity of the members of those larger communities will thereby be less gratified, but their common security and interests will be better attended to. Again, in states too large, unwieldy, straggling and ill cemented together in their different component parts to have all these parts, from one single centre of authority ruled with that knowledge of and that regard to their separate interests, that impartiality and that firmness, which ensure the equal good and welfare of all—in which the advantage of lesser distant districts is often disregarded and sacrificed to that of the parts nearer the fountain head of power—in which even the best and wisest measures, originating in the central seat of power, can often

only with great loss of time and feebly be enforced at the extremities, the distant and disconnected parts had better, for their own advantage and security, separate from that centre, and each form a distinct head and seat of government, from which it may be more proximately ruled with more sagacity, impartiality and firmness. Indeed, like every thing in nature, of which the component parts are only held together by a tie too weak to sustain their weight, such a state must inevitably sooner or later fall to pieces.

As I have already observed, while the representative of the community at large is both intelligent and well intentioned, the more he is trusted—the more power is confided to his hands—and the more he can, without impediment or control, decree and execute measures necessary for the good of all.

But the greater also becomes the risk that, when his judgment or his will becomes perverted, he may sacrifice the good of others which he has engaged to promote, to his own individual advantage: that he may employ the power which the people at large has given him for its common good, against that very people for his own private advantage: that he may use the superior means he possesses in gaining over the armed force, of which the nation has confided to him the command, only for the purpose of protecting that

nation, to forward his private views, and make it assist him in oppressing the people.

It is true, that when the people begin to feel the weight of this oppression too sorely and too generally, they will resist the same, revoke the power it lent; and the more despotic the ruler, the more he stands alone, the less he is supported by other intervening powers, interposed between himself and the people at large, the more, on forfeiting the good-will of the nation, he has to dread from its revenge. In Russia and in Turkey the despot, when he becomes generally unpopular, is forthwith dethroned and murdered.

Still he may take his chance, and often do much mischief where the resistance tohis power is thus ill organized, and is itself by great subdivision much weakened.

But in many states where great power has been given the ruler for good purposes, this power has again been submitted to a certain control and a certain responsibility more legal and better organized. Such control already even in Turkey exists in the hands of the ulema. In other countries it exists in the ministers intervening between the sovereign and the bulk of the people, and responsible to the latter for the actions of the former.

There are countries where this control is produced by the change of the representatives themselves; where this change is so rapid as soon

again to divest them of their power, and render them amenable to the laws, when they have misused it: where the great number of these representatives leaves each individually only a small fraction of power.

It is true, that this rapid rotation, which submits every minister to a frequent apprenticeship, from which the public can derive little benefit; that this very control too much subdivided, which causes a constant friction and resistance, by clogging the wheels of government even when they work for good, may itself do much mischief; but such is the original imperfection of man, that whatever is formed of human materials must have its good mixed with evil.

CHAPTER XIX.

Division of public and reciprocal obligations, duties, and labours.

We have already seen that in early times and small communities, which only contained few members, each singly exercised private pursuits and professions very different and very opposite: that often the same man was fisher and hunter, shepherd and tiller, artisan and manufacturer, raiser of his own produce and trader in that of other people: and that as later the number of men increased, and with them the number and variety of productions and professions, each individual more confined himself to a single pursuit; and professions became more divided among different individuals: people became more exclusively fishers or hunters, shepherds or agriculturists, artisans or manufacturers, producers or tradesmen.

It fares the same with avocations and duties that concern the public at large, as with those of a private nature. In early times and infant communities, which had not a population sufficiently numerous to afford different individuals for each different public duty, the same individual still

often in turns performed public offices of a most different nature. Not only the same man was in turns citizen and soldier, ruler and ruled, but priest and warrior, maker of laws and executor of those laws. It was not uncommon for the sovereign to be the public hangman; and to this day, in the state called Barbaresque, the pacha still often makes it his own especial business to execute the verdict of the judge.

By degrees, states increased and became more populous: as on the one hand each public office singly required a longer apprenticeship, and took up more of a man's time, and as on the other hand there arose more individuals, ready for certain considerations to sacrifice their private interests and to submit to the trouble of these public avocations, each man more devoted himself exclusively to some public office in particular, and left other professions more to other men.

Not only men of quiet and industrious habits found means to devote themselves more exclusively to the arts of peace and production, by sacrificing part of what they earned by these arts, in order to induce other men, younger, idler, more active and more daring than themselves, to devote their time more exclusively to the arts of war and of defence, for the safety of all, so as thenceforth to render the profession of soldiers entirely distinct from that of citizen; but the receipt and the employment of the contri-

butions of individuals to the expenses necessary for the public weal, the administration of the laws, that of the public worship, and that of many other distinct branches of public obligations, were each, for adequate considerations, undertaken by different individuals, no longer performing these duties gratuitously, as what they owed each other and the state for the security, protection, and other advantages which they derived from their fellow-citizens and from the community at large, but with a sufficient trouble and sacrifice of their private interest, to be thought entitled to receive in return, from that public, an adequate remuneration, under the name of salary.

CHAPTER XX.

Religion. Worship.

It is impossible for man to look round and not by degrees to recognise that he himself and all else around him which he witnesses, is subject to some higher invisible power, by which it is controlled: but being in his primitive state of nudity, privation and suffering, more forcibly struck by the accidental and sudden ills of existence, than by its regular, uniform and gradual goods—by thunder and lightning, by the storm and the tempest, and the other means and modes of rapid and violent destruction, than by the smooth and even current of gradual growth and development—man would begin by dreading powers of evil, before he proceeded to recognise, and to look up to powers of good. He would every where seek to avert the ire of demons, before he endeavoured to gain the good-will of angels.

Every where alike on this globe, the first worship was a worship of fear only. Every where a dread of evil preceded a worship of love. Every where the Deity was first supposed to thirst after

blood; to be placable only by sanguinary offerings; to consent only to spare the threatened supplicator on condition of his finding some other victim to be immolated in his place, before God was acknowledged as only desiring charity and good-will between man and man, for the sake of equal welfare to all.

In the struggle and competition for preference in the divine favour by acts of bloodshed, as in every other struggle, the strong and the mighty naturally had the advantage, and the weak and defenceless—the woman and the babe—the humble and the captive—fared the worse, were the beings sacrificed. It even became an idea carefully cherished and propagated by those who, being mightiest, led public opinion like every thing else, that the more innocent and pure the victim, the more acceptable to the Deity became the sacrifice. Thus did the evil-minded make the good atone for their sins.

Human sacrifices, and particularly those of virgins and infants, have in early ages prevailed over every part of the old and the new world. Agamemnon was commanded to immolate his daughter Iphigenia. Abraham was directed to offer up his son Isaac. Later, the children of Israel were made, as well as those of the heathens, to pass through the fire of Moloch. Long after human sacrifice had been abandoned, those of brutes—of cattle—still continued to ensan-

guine the altars, and to sate the pretended appetites of the gods for blood, in order to make the powerful among men fare more daintily and plentifully. It was late, indeed, before the instructors of mankind acknowledged that the only sacrifice the Deity required of man, was that of his evil passions.

By degrees man began to discover that with the ills of life were mixed some goods. He began to suspect that the rulers of this globe were not all demons; that the power of evil spirits was at least balanced by that of good genii. Still would for a time the struggle continue to be carried on between them: still would, during a long period, the host of heaven be supposed occasionally to have their beneficent views thwarted by the powers of hell. Ahriman would still contend on equal terms with Ormuzd; Typhon with Osiris; the giants, sprung from earth, with the gods of Olympus; Satan with Jehovah.

Men would still long, in their reluctance to give up the evil propensities of their heart, try to soothe and conciliate the powers of darkness, and to obtain from these, through bribes, what they had no hopes of more legitimately earning from the powers of light—what they durst not ask from these latter. Even when they already had begun to place their chief reliance on more beneficent gods, they would still think it neces-

sary, or at least prudent, to avert the malice of demons by exorcisms and conjurations. A great part of the religious rites of the ancient magi of Persia, from them to this day called magic, were intended as much to deprecate the ire of the demons as to gain the favour of the gods.

Only at a later period, when man became better acquainted with the course of nature, did he recognise that all the evils, physical and moral, prevailing on this globe, were the direct and inevitable consequences of its peculiar situation in the universe: that they were the effects only of an ordination by which unmixed good was only to be attained in another and higher globe, to which this globe was only a stepping-stone, and where that good would only be felt the more, from its contrast with the present evil. Only at a later period was Satan, as a definite, tangible entity, distinct from and hostile to God, supposed to be for ever subdued, and sent back to, and chained down in that hell, from whence he had been said to come.

Yet was God himself, from ancient habit, still for a time occasionally made a God of wrath. The writings of Moses still continue to clothe him in thunder, to furrow his forehead with frowns, to make him visit the sins of the fathers on their children even to the third generation. The Jews, who considered themselves as God's favourite nation, as by pre-eminence his children,

justified the cruelties they committed in the countries they wrested from other nations, by his express commands; and only our Saviour, at last, preached a different doctrine, and, in the name of the Father of all, enjoined charity and good-will toward men of every denomination.

It is difficult for man in his primitive state of ignorance, even when he begins to recognise a superhuman control, to recognise that control as residing in an entity which itself, as the first cause of all matter, can have nothing in common with any of the attributes of that matter by it created, or even of that mind which, as we have seen, is itself only a later and more partial modification and development of matter.

Nations, already in natural intellect and in cultivation very superior to those that only made their deities monsters and bugbears, still at first believed in a certain number of gods distinct from each other, dividing with each other the control over the different processes of nature, and influencing the feelings and actions of man. They still considered these deities as possessed of a corporeal form, and indeed considered the form of man as only created after the image of that of the gods; and Prometheus, one of these gods themselves, as having incurred the ill-will of the others, and of Jove their chief, by his surreptitious imitation of the divine type. Even

Moses, though intent in the main upon doing away the idea of God's having a corporeal form, and wishing to inculcate the idea of God's immateriality, still constantly describes the Deity as endued with human forms, as well as human feelings, and indeed, as having created man after his image, one does not know why, except he should mean that the angry feelings of man resemble those which he sometimes attributes to Jehovah.

Still was, in the opinion of the most sensible idolaters, the form of man only a very diminutive miniature copy of the stature of the gods. Homer makes Neptune, at single stride, compass the Egean Sea; Minerva, with her single helmet, cover fifty cities.

The Greeks, in order to produce of the supposed forms and dimensions of their gods a livelier impression, wrought of these fictitious gods real images, as colossal as they fancied the originals; and, with the view the more to favour the illusion, built round those images temples, in which they only allowed them to be seen through the medium of a light which, leaving all else around in darkness, fell concentrated on their figures alone; and which moreover had, in addition to the forms, all the colours imitative of those of nature, capable of diffusing over them the glow and animation of life.

While deities were supposed in their form

and disposition so strongly to resemble human beings, it was not unnatural to suppose that among their worshippers they should have had especial favourites; men whom they suffered not merely to behold their portraits; whom they would sometimes honour with a view of the originals, though on a scale so far reduced from that which they usually bore in Olympus, as not to overpower them by their presence. Homer constantly represents his gods as conversing with his heroes, under the assumed form of some of their earthly friends; though Jupiter, forgetting this precaution, and appearing to Semele in all his glory, annihilated her at once.

The immaterial God of Moses could no longer, as such, consistently confer with man face to face: but he still communicated with certain peculiar individuals more directly, through the medium of superhuman messengers called angels. Not only the word αγγελος in Greek, but Moloch in Hebrew, and Melek in Arabic, literally only signified messenger.

When we read in Scripture of angels, we figure to ourselves beings of miraculous beauty, furnished with splendid wings, wafting their aerial bodies from the heavens; and we consequently are rather surprised at the little sensation of astonishment their sudden appearance seems to occasion in those men to whom they are sent. The truth is, that, like the gods of the Greeks,

they are only described as appearing to man stripped of their distinctive insignia—as ordinary wayfarers; and seem only to have been recognisable in their superhuman character, if at all, by the nature of the tidings with which they are fraught.

Thence it was that, in days of ignorance, strangers from distant countries, fraught with superior knowledge, might often easily avail themselves of their incognito to assume among the Greeks the character of gods, and even, among the Jews, that of messengers of the Deity —or at least of men specially inspired by God with the foresight of events to come,—of seers; of prophets. Every day, in Jerusalem, started up individuals who pretended to possess the gift of predicting the future, or who even honestly believed those dreams and visions, which perhaps they only owed to a disordered stomach, to be inspirations from on high. But by degrees men, by greater information rendered more cautious, learnt later how to distinguish false miracles from true prophecies.

While some people sought the gods which they supposed to rule the destinies of man near the earth, others only found the ruling powers in the most distant regions of the heavens.

It was difficult, in countries where the sun's beneficial influence over this globe was constantly felt, in ages of ignorance, not to regard

that celestial orb, so strongly connected with the fate of man, as itself the ruling deity, rather than a later and more partial effect only of the almighty first cause. In those finer climes, indeed, where the greater purity of the atmosphere leaves not only the sun but the moon and the stars their utmost brilliancy, and where man is often driven by the heat to spend his nights on the terraced roof of his habitation, in contemplation of a glorious firmament, these latter bodies too would, by the regularity of their movements, come in for their share of man's veneration, and seem, when the sun disappeared from the horizon, to be his vice-regents.

Thence would, in many countries, the heavenly bodies—the sun, moon, and stars—first themselves be worshipped as deities. Sabeism is one of the oldest and most primitive of creeds; and terraces or lofty precincts, destitute of roofs or coverings, were among the most ancient of temples.

Of such a sort was the stupendous tower erected on the banks of the Euphrates, in that city whose name, composed of that of bab or gate, and that of bel or the sun, in the Assyrian dialect was derived from, and signified the approaches of the temple to that deity, which was in it the chief object of worship: of such a description is the roofless temple that still subsists on the site of Persepolis.

In these edifices the sacred fire, offspring and

emblem of the sun, from which it was directly drawn, and sometimes also, those atmospheric stones, regarded in early times as directly dropped from the sun, and often mentioned in sacred writ under the name of Bethyles, had their share of worship; and the sacred stone, so long venerated at Emesus in Syria, was by its highest priest, Heliogabalus, when elected Emperor of Rome, in great pomp transferred to the capital of the world. Previous, however, to this occurrence, the worship of the celestial fire, which originated in Persia, seems already, under the Persian name of Vesta, to have travelled with the sun as far westward as the utmost Celtic tribes, stopped in their further progress by the waves of the Atlantic. We find representations of Mythras even among the remains of ancient Gaul. It was when christianity spread its light over the globe, that the sun and moon began to be considered no longer as themselves ruling man's destiny, but only as, together with man himself, obeying the impulse of a first cause, earlier and more powerful than either. Then it was that astrology gave way to astronomy: that the movements of the stars became watched from high places, no longer as directly announcing the fate of man, but as proceeding from certain principles in nature, to which stars and men were equally subserv[illegible]

At first among na[illegible]ong which arose a certain creed, that cr[illegible]e their other con-

quests over nature, was by them considered as their exclusive property. They were jealous of the privileges it promised: they grudged the intrusion of strangers into their own especial heaven. They feared it would not prove roomy enough for all. They wanted to keep strangers out. When unknown supplicants knocked at the gates of their temples, they were refused admittance: they were not even permitted to peep in at the door: all within was rendered an inscrutable mystery. Rather than run the risk of divulging the sacred rites to strangers, they consented to have these rites, and the offices of religion, confined to a small and select portion of their own nation. Among the Jews, only the Levites were permitted to penetrate in the holy of holies; among the Greeks, none but the initiated partook of the mysteries of Eleusis.

In later times, as opposite extremes ever precede the just medium, men were forced to adopt the prevailing creed of the land, whether they would or not. Bigots persecuted those who were dilatory in accepting their belief. In their excess of zeal for the conversion of heretics,—in their solicitude to save them from the fires of hell,—they doomed them on earth to the flames.

Only very late and partially have both extremes been avoided. Only very late and partially have men begun, on the one hand, to receive with open arms those whose eyes were

opened to truth, and yet, on the other, no longer to persecute those who still, without their fault, continued blind: no longer to treat as a fault what was only a misfortune. Some even presume to think that that blindness itself still leaves a chance of salvation, so those who still mistake their duties, perform conscientiously what they consider as such. They think that whatever may be a man's creed, he may, in the exercise of true charity, find a passport to heaven: they think that a religion cannot, on the whole, be bad in its principle and its consequences, which inculcates universal love, good-will, and good deeds; which has for its object the welfare of man.

CHAPTER XXI.

Priesthood, priestcraft.

At first every man who had made himself a god, when he wanted to be spared an evil, or to be granted a boon, addressed his petitions in person to that god. He was his own priest, and when around him rose a family of which he remained the chief, he continued to offer up to his god the common supplications of its younger members, of which he was the representative. Where a certain number of families associated in choosing a common chief to manage their temporal affairs, this chief became likewise entrusted with their spiritual concerns; he was the principal mediator between them and their gods; their high-priest.

By degrees the contemplative and peaceful pursuits of the priesthood were judged incompatible with the active and warlike occupations of men, called upon to manage the affairs of the world, and were left to such among the community as, from the superior sanctity of their lives, were supposed to enjoy most favour with the gods, and to be most fit to intercede with

these in behalf of the remainder of mankind. They availed themselves of their high office to rule their constituents in the name of the deities whom they pretended to consult.

Where the stars were considered as those gods, or at least as by their movements more directly announcing their will, the science of astronomy, or rather of astrology, became the exclusive study of the priesthood; but this body used other means to increase its influence.

Men are subject to afflictions and scourges. Their crops are destroyed by deluges and conflagrations. Their cattle die of disease. They themselves are laid prostrate by plague and pestilence. At first these calamities, of which the natural causes are hidden from the vulgar, were attributed to supernatural agency—to the wrath of heaven. The removal of that wrath was not sought in medicine: the gods were to be placated. A double dose of blood was spilt to soothe their anger. By degrees the priest discovered that human means and medicaments were of use in the cure of complaints, but as long as possible they tried to monopolise the healing art, by pretending that medicine only acted under favour of the gods; and still made the dispensing that medicine their exclusive profession.

There are nervous complaints, such as epilepsy and convulsions, at once violent while

they last, and during their intermittance leaving no tangible trace. Of these the infliction appears to proceed more directly from superhuman causes, and the cure to be more directly within the province of the priest. More than other maladies they seem to elude human powers.

These remained last of all the exclusive property of the priesthood, and were only to be removed by exorcisms, or by prayers. I myself have witnessed at Naples the ceremony of expelling evil spirits, and, strange to say, they yielded for a time to the imprecations pronounced against them from the altar. Such is the power of the mind over nervous complaints.

As the same views influence men of the same profession in every part of the globe, the two most powerful engines of sway over the mind, hope and fear, were long monopolized by the priesthood all the world over. In India the Brahmins, in Persia the Magi, among the Egyptians the ministers of Osiris and of Isis, among the Greeks those of Apollo and Æsculapius, and among the Celtic nations the Druids for a long time remained the only physicians. The brazen serpent promised health alike in the deserts of Palestine, and in the groves of Attica, and every where the sick were carried to the porticos of the temples, to await their cure or their release.

In many countries moreover the priesthood,

in order to establish their power more firmly, ordained that children should follow the professions of their fathers. The division of the nation in casts, while it secured the priesthood for ever in the families that possessed it, in all the rest of the population extinguished every feeling of emulation, every hope of improvement in art and in science. Still this absurd and detrimental law prevailed alike among the Persians, the Assyrians, the Medes, the Egyptians, the Jews, and even the Celtic tribes. As among the former the Levites, among the latter the Druids alone exercised all the professions connected with the priesthood.

We have seen the use made by the priests of Egypt of their symbolic language, in closing the doors of knowledge as long as they could against the intrusion of the people at large. Even after, spite of their efforts, philosophy had begun to penetrate, they still continued as much as possible to stem its torrent, by dividing in two distinct branches the doctrine they taught. That of the earliest, most figurative and most extravagant description, remained under the name of esoteric the theme of general tuition. The more rational doctrine which made its way in despite of the priests, that of which they passed off the former as the type, but which, under the name of esoteric, they withheld from the vulgar as dangerous, and above its compre-

hension, they indeed made a merit of divulging to the more enlightened, from whom they could no longer withhold it, but under the seal only of a secrecy, guarded by the direst oaths and penalties.

At last science became sufficiently diffused to teach priests themselves, that their chief office consisted in reminding the people at large, of what in the bustle of worldly business men are too apt to forget, namely, that the practice of virtue is the surest road to happiness; and that their chief duty is setting the example of what they were called upon to preach.

CHAPTER XXII.

Love of metre and cadence.

Already the higher brutes are playful. They seem in infancy, by the mere exuberance of their spirits, propelled to actions which have no purpose but that of venting their effervescence. But in brutes these sports and gambols generally cease as soon as the real wants of the body are sufficient to employ all the activity of the mind. The playful kitten soon subsides in the demure watchful cat. The wild colt soon becomes a sulking horse. The frolicsome kid grows a grave bearded goat. The romping pig turns a grunting sow. The very elephant, full of fun while a baby, assumes, as he advances in age, the stateliness becoming his gigantic size. The very monkey alone continues his pranks with the sorrowful air of an animal who only performs them from an irresistible impulse, not from choice: and only domestic pets more pampered than usual continue all their lives to evince the vivacity of youth.

Man himself in a state of nature enjoys but a short period of careless mirth and hilarity. As soon as hunger begins to pinch, as he feels called upon to consider how he shall provide for the passing day, he finds in the occupation of hunting or fishing an ample vent for his spirits. When by dint of great toil his wants at last are satisfied, what he seeks is not relaxation but repose. Between his labour and his rest he has not leisure to laugh and be merry.

But man who has secured a sufficient sustenance can at times afford to throw off care. He feels his spirits sufficiently buoyant to want some pastime, for the sole purpose of venting their exuberance. The disposition to merriment shows itself as soon as from an earnest hurried gait, leading him to some direct object and purpose, he launches into some desultory hop, step and jump, only calculated to lift him from the ground.

His lightness and buoyancy of spirits then already push him on to incur, in chasing the wild beast, more toil and danger than ever he experienced in pursuing the prey wanted to appease his hunger, to sustain bare life. It makes him invent artificial sports and gambols to get rid of the fever of his limbs. It leads him to contrive new combinations of flavour, odour, sound and sight, no longer to gratify any want of the body,

but only to afford to the sense greater amusement and pleasure.

In animals the external forms are symmetrical. This causes even the movements by these forms involuntarily exhibited to become so likewise. Their gait is cadenced, their actions are measured, their very cries are rhythmic; but theirs is still only the rhythm of nature. The natural measure of their movements is not enhanced by art.

But of the organs of man, the spontaneous symmetry and correspondence, much more complex and crowded, cause the simplest movements of mere necessity already to be greatly facilitated by a certain artificial and intentional cadence. Where parts very numerous and very diversified are very close wedged, symmetry in their respective movements leaves each more room in its turn to act and exert its full force, unimpeded by the rest; and leaves each in turns, after its period of exertion, more fully to enjoy a period of complete rest.

Thence already blacksmiths in a forge naturally strike the hot iron in cadence. Sailors keep time in turning the capstan: boatmen raise their oars regularly; and common criers use a rhythm in crying their ware. They find it lighten their labour.

And not only artificial movements, performed

for some useful purpose, are carried on with more ease when performed in cadence, but artificial forms and combinations, composed in view of some advantage, generally answer better, when directed by a regard to symmetry. More is done in less time, and in less space, with less exertion and greater success.

Of a garden for use the different produce is easier raised, easier managed, easier calculated, easier collected: vegetation grows more speedily and in less room, when the compartments are regular.

Of a house the distribution is better, the construction easier, the firmness and durability greater, as the angles are more regular, the walls more upright and the ceilings more level.

And not only in proportion as movements are more metrical, as cries are more cadenced, as forms are more symmetrical, is the performance of them easier to the author, but the perception is also to the beholder more agreeable, more free from exertion, from labour, from fatigue and from pain.

In consequence of the impressions made by regulated modifications on the organs of the different senses being more free from inequalities and jolts; of their not falling on them in such unequal proportions; of their not weighing on some too much and on others too little; of their not overstraining some organs, while they leave

others void of exertion, but of their falling more equally on all, and giving each in turn a more exact measure of that alternate exertion and repose, necessary to afford pleasure, and to steer clear of fatigue and pain, they occasion a collective enjoyment much greater, and yet less alloyed by exhaustion.

Thence the preference we naturally feel for metrical movements, cadenced sounds and symmetric spectacles.

Already the babe at the breast finds more pleasure in being dandled or rocked regularly: in listening to a rhythmic see-saw, in being shown a symmetric object. Already the youth, in his listless moments drawing with his finger lines in the sand, mechanically draws these in symmetric order.

Every one knows the pleasure afforded the ear by melody and by song, nay by articulated words —by alliteration, by rhyme and by verse—even while all the merit still only lies in the mere sound; while that sound is void of sense.

Every one equally allows the delight afforded the eye by colour, forms and movements that have a correspondence of opposite parts. Every one agrees that even natural objects are handsomer to the eye in proportion as to their other merits they add that of greater symmetry.

No doubt a fine landscape, a glorious sunset, may already greatly delight the eye without any

symmetry: but how much greater the power of pleasing, the beauty, comprehended in a much less portion of space, presented by the forms and colours of a beautiful plant, an elegant flower, an insect, a bird, or beast, or above all a human being, in which we see at once regularity of outline, and grace of movements, united in the highest degree. From the view of this latter, we derive in all its perfection that contemplative pleasure which is the peculiar effect of beauty.

Nor does cadence and symmetry give superior pleasure to the sense alone. By the evidence it affords of forethought, of calculation, of a plan well formed and well digested in the mind of the artificer, even before the work is begun, it also affords superior pleasure to the mind of the beholder.

Thus it is, that in objects of art as of nature, cadence and symmetry increase their beauty and their power of pleasing, as long as to these charms have not been sacrificed other powers of pleasing, other beauties of an intellectual sort, even greater than those of rhythm, of symmetry themselves.

Though we admire in a garden or a picture a beautiful symmetry, we shall, perhaps, admire a garden or a picture still more, in which that symmetry has been sacrificed to the faithful imitation of a grand but unsymmetric scene of nature.

Men, moreover, found, that metrical movements and forms not only were easier executed by the performer, but made a stronger and more lasting impression on the beholders. As long, therefore, as writing remained unknown or little practised, intellectual performances were, for the sake of utility as well as of beauty, compressed in a metrical form. Homer's historical records and Hesiod's didactic works are both written in verse.

So much do the superior powers of pleasing, the superior beauties of metre and cadence, proceed from its peculiar correspondence with and suitability to the organization of man, that there hardly is a nation still so rude, so unimproved by nature, so little advanced in art, that has not already, in order to while away its leisure hours, invented some sort of dance, of song, of music, of verse and of poetry: who even does not, in daubing his body with grease or paint, show some regard to symmetry.

Imitation either of mere bodily modifications, or of intellectual phenomena, adds to the former species of beauty—to the former powers of pleasing—new beauties and new pleasures. Even of an object ugly or disagreeable in itself, the good imitation, in its capacity as giving the beholder employment for this mental faculty of comparison, and as affording him proof of the mental faculties of the performer, has already in

it great powers of pleasing, which it loses as soon as the imitation is mistaken for the original imitated itself; when it no longer can please more than that very original would have done.

The good imitation of an original in itself handsome and pleasing, is doubly pleasing, first from the nature of the original, and next, from the greater beauties which it offers as imitation. It is this charm, inherent in all imitation, that already causes most nations at all civilized to invent some sort of mask or mummery, some pantomime or drama, as well as some sort of sculpture and painting. The difference between the productions of art, unimitative and imitative, of the rudest nations, and the painting and sculpture, poetry and drama of the ancient Greeks, lies not in that of their origin. These are the same. It lies only in that of their development and splendour.

CHAPTER XXIII.

Society, morality.

Even the brutes most gregarious, only attracted to each other by the impressions of the sense—the feel, the smell, the hearing, or the sight—still incapable of exerting over each other any attraction of the mind, have no society. Amid troops of their species each remains solitary. Man himself in a state of nature can hardly be called a social being. Approaching a female only in consequence of a sexual desire, again abandoning her as soon as his wants are satisfied, he has with her no intercourse of the mind. He feels not jealous of a successor in her affections. If the woman bears the fruits of her compliance, uncertain to whom she owes them, she transfers not to the child any affection felt for the father. She only loves her babe for its own services, in ridding her of a burdensome milk. When the physical wants which mutually attached to each other the mother and child subside, all further society between them ceases; each goes his separate way, as urged by separate wants, the mother to seek a new mate, the offspring in

search of more substantial food. Individuals of the same sex only exert over each other a power, not of attraction but of repulsion. Each fears, like the spider, to be devoured by the other. Man roams over the wide wastes of nature single, distrustful, and afraid of other men.

Later he may feel the want of some companion to assist him in attack and in defence. He finds it better to divide a prey, than to go without food. From such motives arose the companionships of Hercules and Lycas, of Theseus and Pirithous, Achilles and Patroclus, Orestes and Pylades, and others whom the Greeks have exalted into models of the most generous and disinterested friendships. With the increase of subsistence and of security, man's mind expanded. He then felt the want of social ties more extended. The brotherhoods of heroic ages were succeeded by a more general love of society, of conversation and of conviviality.

At first, the social compact only embraced duties which it was easy to define. I shall abstain from doing my neighbour certain injuries, provided he abstain with me from the like. I shall render him certain services, so he make me a similar return. But there are a thousand good offices which cannot be defined, still less be returned in kind: though they produce in the receiver a good-will, which makes him in return

render other services of far greater value. By degrees, the sense of the gain derived from this general good-will produces good breeding and politeness. When these proceed from pure benevolence of mind, pure wish to make others feel comfortable and happy, pure warmth of heart, they attain their perfection.

CHAPTER XXIV.

Sympathy.

SYMPATHY exists not in brutes. They cannot even imagine each other's bodily sufferings: much less those of the mind. Even if they did, their imagination is not vivid enough to sympathize with these pains of others: to feel them as if they were their own. A sheep in health skips heedless over a wounded sheep. The gentlest dove pities not the dove who has lost his mate. Human beings themselves, while young, feel little sympathy. Children delight in tormenting brutes. Nay, among the lower orders, men grown up seldom acquire that fine feeling. They become sociable, they become friendly to those they love, but they feel no participation in the sufferings of indifferent persons. They encourage cruel sports, they flock to executions. There have even risen nations eminently civilized, which with all the polish of marble still retained all its hardness: of whom none yet conceived what we call humanity. Of the Romans, the rejoicings, the triumphs, began with the cold-blooded immolation of their most illustrious captives: their

very favourite games themselves were sanguinary. They delighted in slaughter: and the softer sex, the vestal virgin, was foremost in bestowing the applause. Terence's famous speech, "homo sum," or at least the sentiment, was borrowed from Menander. The Greeks were the first who raised an altar to Pity. Christianity has first built around it the temple, has first made man regard the vicissitudes of every other man as his own.

CHAPTER XXV.

Education.

Brutes have not imagination enough to conceive more than what their senses tell them outright. They feel consequently no curiosity yet, respecting things unknown. Man does, and curiosity concerning things trifling and not worth investigating in its turn begets love of science, or curiosity respecting things, of which the knowledge repays the trouble of acquiring it, and may directly answer the most important practical purposes.

Brutes, having no wish to acquire knowledge, can have no desire to impart any knowledge acquired to others; but human beings go on accumulating information, till they overflow with it; till they again feel a want to communicate to others that which they have acquired.

Thence, while nature in brutes, on every individual placed in similar circumstances, acts in the same way, and makes not the later individuals through more experience improve upon their predecessors, she makes, in the human species, the earlier individuals the receptacles of expe-

rience, through means of which the later ones may be made to set out in life with a stock of knowledge more easily acquired, more abundant, and able, with less pains and trouble, to produce a richer interest. Children, born to a greater capital than their fathers, may in every generation more increase their income. By means of education they may, without serving long apprenticeships, at once profit by what their fathers had only through dint of dear-bought experience first acquired.

And the pleasure of exerting influence over others, and particularly those we love, insures in all men, and particularly in parents, the inclination to advise and instruct their children.

Unfortunately children are not so ready to take advice as parents are to give it; nor is it even sure always to be good. Men are often by reason ill directed made to give bad examples, and to instil erroneous precepts. This already is the case in private education.

But, for the sake of improving youth more wholesale, men have established schools, where education, instead of remaining in the hands of the parents, interested in the morals as well as learning of their children, has been intrusted to venal strangers, who without any interest in, or affection for, their pupils, only perform their task for hire; and find no inducement in love for those under their tuition, to add to the benefit of their

lessons that of their example. To the flexible mind of youth these schools, in which the boy suffers in being estranged from his home, his parents, or what is worse, learns no longer to care for the privation of what nature ought to have rendered most delightful to them, often, instead of being promoters of virtue, only become seminaries of vice; and men often at school only contract illiberal ideas and vices, which in after life the larger education of the world deems it a gain merely anew to unlearn, and to exchange, even for vices and for prejudices more liberal, and more adapted to society at large.

Thus takes place the insensible progress from nature to art, and from rudeness to civilization. This progress may long go on without interruption, before it has saturated every region with as much happiness as this world will hold. Violent checks and retrogradations may render this period still longer; still render the ultimate term more distant. But it is physically in the list of possibilities that some time or other this globe may not afford room for further increase of the happiness which it abstractedly is capable of containing.

CHAPTER XXVI.

Virtue, vice, crime, morality, immorality, good and bad conscience, remorse, shame, modesty.

We name that consideration which makes us sacrifice what to ourselves or to others would be a source of pleasure, nearer but smaller, to what to ourselves or others would be a source of advantage and enjoyment, more distant but greater, a consideration of utility. We consult utility when we sacrifice the pleasure of a dainty but expensive feast, to the gratification of being able to go well clothed for a twelvemonth. As soon as we sacrifice our private pleasure or utility entirely in any thing to the well-being of the community at large, that act of utility is called an act of virtue. It is not because certain acts are virtuous and good, that they are expedient; it is because they are expedient, are good, are calculated for the well-being of the community, are of a nature to promote its general interests, peace, security, well-being, that they are virtuous. Things which in one state of society may tend to promote its peace, its security, and may be considered virtuous, or indifferent, may

in another state of society produce discord, disturbance, disorganization, and may be reckoned vicious, criminal.

Brutes, though by instinct made to do what is immediately salutary to them, and to abstain from what is immediately detrimental to them, being incapable of entertaining abstract thoughts, cannot have any idea of utility or of detriment; they can as little have any idea of virtue as of vice. Whatever they desire for their private gratification, unless prevented, they do. It is fortunate for others that they only desire to do that which tends to their bodily gratification.

Human beings in a state of nature resemble brutes. Innocently, when themselves feel so inclined, and while still unprevented by others, they rob, they ravish, they murder; they do not think whether what they do be virtuous or vicious, laudable or criminal; nor, if they were told, would they care. They feel no scruples before they commit an act, tending to their gratification, nor are they, after having committed such an act, visited by any upbraidings of conscience. Why should they not please themselves when they can?

But human beings, when, to reap greater advantages from the sacrifice of more transient pleasures, they established expressly or tacitly a social compact, called the things conformable to its spirit, and tending to confirm the general

peace and well-being which it had in view, virtuous; as they called the things contrary to its spirit, and tending to disturb the general peace and welfare which it enforced, vicious, and when very heinous criminal.

Thus arose ideas of virtue and of vice; and as more acts were deemed deprecable, and calculated to disturb the civil compact, and the well-being of the society it had established, more things were called vicious and criminal; and as more acts were deemed desirable, and calculated to promote the existence and the views of the civil compact, and the peace and well-being of society, more acts were deemed virtuous.

At first only great ability, physical and mental, to defend the commonwealth against that aggression from individuals to which infant societies are constantly exposed—great bodily strength and great mental daring,—were alone called virtue. While woman was considered public property till a man made her his own; while he then only prevented others from enjoying her as being his peculiar appropriation; while he blamed not in others the wish to possess her, where the husband himself was disposed to lend or give her, continence was not yet, abstracted from the rights and feelings of a husband, reckoned in itself a virtue.

Later, not only strength and courage to maintain the social compact in war, but services rendered it in peace—patriotism and public spirit

—were considered as virtues; profligacy, as tending to disturb the peace of families, to disunite husband and wife, to render doubtful the claims of children to their parents' affection, were then also considered as vicious.

Still to the last, as on the one hand what is calculated to keep up the social contract, and the peace, happiness and security of the society by it established, is deemed virtue; and as on the other hand, what is calculated to disturb that civil compact, and the peace, happiness and security of the society by it established, is deemed vice or crime, it is plain that in different states of society, and with different social compacts, the same acts must be deemed more or less virtuous or vicious; and that often the very same thing which in one state of society is deemed indifferent, or even virtuous, in another state of society must be reckoned vicious or criminal. The ancient Persians deemed it laudable to marry their mothers; and if to prevent a town built of wood from being burnt down, a general law established that no man was to smoke a pipe in the street, contravening to this law would become highly criminal.

There are things which, though in the aggregate highly detrimental to society, individually seem so insignificant, and so difficult to define, that no express laws can be contrived to prohibit or to punish them. Those only called immoral

must be left to the estimation and the punishment of society at large, and they will in general, by society at large withholding its good-will and its services from those guilty of them, at last be punished more certainly and more severely than those deeds only threatened with express penalties.

People have said that there was in our hearts a conscience, which told us what was intrinsically good or bad, and upbraided us for doing what was bad. Nothing seems intrinsically good or bad. The Indians under certain circumstances even applauded parricide. Every thing is only deemed good or bad as circumstances make it. Conscience thus is only the later effect of the estimation in which our deeds are held; of the applause or reprobation they are calculated to inspire. Not only the same thing will sit heavier or lighter on our conscience, as it is less or more tender and timorous; but the thing which in one state of society will cause its depression, in another will cause its exultation.

It fares with shame as with remorse. The savage feels none. The civilized man feels none while alone, for what he feels ashamed of before others. It is not the thing he does, but the opinion he occasions of himself in others for doing the thing, or for doing it before them, which he fears. Perfect innocence feels neither remorse nor shame. Modesty is a fruit of civilization.

CHAPTER XXVII.

Nature and causes of evil.

I HAVE carried my general contemplation of the developments, natural and artificial, of this globe to the utmost height at which they were calculated to produce good, benefit and happiness, and to obviate evil, detriment and suffering. I have not yet extended my view to any of the by-paths through which modifications were made to lead to evil, detriment and suffering.

What, may some ask, is evil, detriment? Evil is that which prepares the way to suffering. An earthquake, a thunder storm, which cause certain sentient entities, even long after, to suffer in body or in mind, so far already are evils. Suffering is, in sentient entities, the actual pain, bodily or mental, resulting from that evil.

But is there, on this globe, any real evil and real suffering?

I know very well that some have said not: because, on the one hand, all the evils which we find on this globe only arise out of the disproportion relative to each other, presented by certain elements which, in other and different propor-

tions relative to each other, would only have produced unmixed good and happiness; and because, on the other hand, these very evils themselves, only arising out of the mere disproportion between certain elements of good, often again lead to later recombinations of them in other different proportions, ultimately conducive to good and happiness. These people are called optimists.

But whatever leads to suffering, so far leads to evil. Suffering itself, whether bodily or mental, no matter what earlier modifications it arises from, or what later modifications it leads to, or how long it lasts, while it lasts is intrinsically an evil; and there is on this globe an immense quantity of suffering, both physical and mental.

It is nevertheless true that all evil, all suffering, bodily and mental, only arises out of a later unravelling and decombination of those very elements and substances, of which a prior combination had produced prior good, a prior tendency to pleasure, or a prior actual pleasure; that evil is only an episode in the current of natural developments, of which the history is that of good; that, as all unravelling and decombination can only arise from a disproportion relative to each other, borne by certain of those same opposite elements, of which a prior different proportion relative to each other produced combination—as it can only arise from one of the two opposite

elements, which, when they press against each other with equal force, combine together, pressing against each other with force so unequal, that while the one is still permitted to advance, the other is made to retreat before it, to retrograde, to fly, and to disperse in space—all evil can only arise from a disproportion in the quantity of those very elements which, in other and different quantities and proportions, relative to each other, produce good.

In fact, try any sort of evil, of decombination, we please, from those decombinations of a physical sort most early and elementary, which may have taken place longest before any sentient entities, capable of suffering from their consequences, yet existed, and which only from a great prior distance in time prepared the means of actual future sufferings, physical or mental, to those other decombinations, physical or intellectual, which in sentient entities are most immediately followed by actual present sufferings bodily and mental most acute, and the evil, the suffering will universally be found to have arisen from certain opposite elements, which in peculiar relative proportions would have increased combination, meeting in other different peculiar relative proportions,—from one of those opposite elements meeting the other in a quantity, and with an impetus, so much greater than that with

the other resisted that quantity, that impetus, that, in place of the two opposite elements being each through the other rendered alike stationary, and being at a point intermediate between the two opposite prior ones, from which they approached each other, made to combine together in a third production, singly different from either of the two former, the strongest, continuing alone to advance, forces the weakest again to retrograde, and in its divergence in a backward direction, to lose itself in surrounding space.

Already, if of that force most early and universal of any, called the force of gravitation, of which opposite portions made on other forces and elements, floating in intermediate space, from both sides to press with equal intensity, will press these in the form more definite, solid, and lasting of a globe capable of becoming in its turn the foundation of other substances and bodies supported by it, opposite portions be on other forces and elements, floating in intermediate space, made to press from each side with a different degree of intensity, they will of these intervening forces and elements cause the greater portion from one side to be driven beyond the common centre, and of the other weaker portion, coming from the other side, again force a part, before the portion coming from the opposite side, to revert to the point from whence it came, to

retrograde, to diverge, and to disperse; and if former opposite portions of different elements and substances should already have contributed there to form a globe, of that globe again to cause part to be decombined.

Again, if of that electricity, of a compressing and condensing sort, called cold, of which opposite rays, made to press on other forces and elements intervening between them, produces in these a combination and condensation even more forcible and tenacious than that caused by mere gravitation, called consolidation and crystallization, and of that other electricity moving in a contrary direction to that of cold, called of heat, of which the rays, penetrating within the condensations formed by cold, again distend, and separate these, so as to make the forces and elements before compressed and consolidated return to a state of dissolution, fluidity, gaseousness and radiance, of which two opposite electricities of cold and heat the intermixture with each other in certain proportions, causes in the substances on which they act that intermixture of solids and fluids which produces the movements of life, the intermixture with each other again takes place in certain other proportions so different from the former ones as to make all the fluids become solid, or again as to make all the solids return to a state of fluidity, this intermixture will in opposite ways again prevent that cir-

culation, or where it had already taken place, will again make it cease, and cause the life already produced again, either by too general a solidity, or by too general a fluidity, to end in death.

Again, of that heat from on high driven down to our globe, and of that humidity from our globe driven upward into the atmosphere, of which the meeting in certain proportions will arrest each other, and cause the combination or increase of bodies vegetable and animal, the meeting in other proportions, different from the former ones, will produce effects so different that, if heat preponderate too much, it will of the soil before moist and fertile dry up all the moisture, and will render it a mere arid desert, and that, if moisture preponderate too greatly, it will convert its whole surface into a swamp or puddle.

Of the other elements and substances, from the atmosphere by gravitation of a centripetal sort driven down to this globe, and of the other elements and substances, from the body of this globe by gravitation of a centrifugal sort driven upwards into the atmosphere, of which the meeting in certain proportions likewise produces mutual resistance, and, through this mutual resistance, the combination in solids crystalline, vital, sensitive or intellectual, the meeting in other different proportions again produces, where by no prior similar opposite forces, elements, and substances any prior combinations yet have

been formed, the unproductive repulsion of the one, and as unproductive pursuit of the other, and where such combinations and solid bodies have already been formed, only again produces their later decombination, and unravelling in the way of sudden explosion, or more slow combustion or putrefaction, by means of which their component ingredients are again made to separate, to fly off, to disperse, and to disappear in more extensive and distant surrounding space.

Should in bodies vegetable and animal, of the aggregation of opposite component elements already formed, of which further substances more aqueous from underneath ascending, and further substances more aerial from on high descending, when meeting in certain relative proportions, only increase the growth, and development, and expansion, these further opposite substances only meet in certain other different relative proportions, in which they no longer are able to balance each other, the new formations deriving from them on one side will at last so exceed the new formations deriving from them on the other side—in vegetables the roots will so exceed the foliage, or the foliage the roots,—and in animals the parts gastric will so exceed the parts pulmonic, or the parts pulmonic so exceed the parts gastric, that by oppression of the one or the other,—by repletion or by exhaustion, or both,—

the whole entity will at last again be made to decombine and to die.

Should in animals the more aqueous veinous blood from within ascending into the lungs, rise in these in quantities greater than the aerial elements from without can resist and combine with into sufficient arterial blood, this veinous blood, first and to a certain degree necessary to the combination of animal organs, will at last again so overpower and oppress the parts formed, as to make them, by stagnation, repletion, and dropsy, lose their faculties and forms, decompose and die: or should, on the contrary, in those animals, the aerial elements from on high descend into the lungs in greater quantities than the veinous blood from within rising can resist and recombine with the same into sufficient arterial blood, necessary in order on the prior parts merely vital to superstruct other new organs sensitive and mental, these elements from on high will entirely consume the vital parts already formed, and make the animal, by exhaustion and consumption of its very vital base and foundation, again give way and die.

CHAPTER XXVIII.

Continuation of the preceding chapter.

We have, in the former chapter, said that only the same opposite elements which, in certain proportions relative to each other produce good, utility, benefit and happiness, when in proportion relative to each other different from these former ones, produce evil, detriment and suffering.

To this assertion some people may find exceptions. Because the incipient degrees of sensation, though ever beginning in sensations of sheer enjoyment, are often so feeble and so short as to be subsequently entirely looked over, and forgotten in the later and higher degrees in which they become painful,—because when a sensation, become painful, is again made to cease, a subsequent sensation of pleasure is felt more rapturously than one not preceded by a sensation of pain,—and because, in human beings, the first external movements and demonstrations that seem to arise out of and to indicate internal sensations, seem to indicate prior internal sensations of pain, some persons have thought that the first sensations of which we are susceptible are really sensations of pain: that sensations of pleasure only

come afterwards as a relief from prior sensations of pain.

Were this in reality the case, sad indeed would be the lot of man. Pain being ever the prior condition—the *sine qua non*—of sensation, and pleasure being only its later eventual consequence, the sensation of pain would always, where sensation existed at all, be certain, that of pleasure only be uncertain, doubtful. We must always experience pain first, and in the greatest and most certain quantity, and pleasure last, and in the smallest and most precarious degree. Life must, from its first dawn to its ultimate close, be in man a dark and losing concern; and the more we lived on—the greater the number of faculties of sensation, corporeal and mental, we received—the greater would with these become the chance of the sufferings exceeding the pleasures of existence. Man would then, instead of only, like the tyrant Polycrates, doing enough to insure his happiness by inflicting on himself some voluntary but bearable woe, by which to buy off the more serious miseries incidental to humanity, never be prompt enough in extricating himself at once from all the untoward chances of existence, by putting to its duration a final end. Man would then act wisest by plunging, not merely his finest gem, but his very person, in the deepest abysses of the ocean, and thus at once destroying in its very source that series of ills, which, the more he

allows life to run on, the more the preponderance over that of its goods must needs increase.

But in reality such is not the case. Already the instinctive love of life—the reluctance to part with existence—so prevalent not only in those individuals reckoned happy, but even in most of those suffering under great afflictions of body and of mind, assure us in most cases of the contrary, assure us that in most cases, even in those deemed most miserable, the enjoyments of life still preponderate over its sufferings; and the more we analyse the detail of the different sources of happiness and misery, the more we find the preponderance of the former over the latter confirmed: the more we find that the former exist first, and may exist without being followed by the latter;—that the existence of the former is the rule, and that of the latter only the exception.

We have already seen that every organ of every sense—whether of touch, taste, smell, hearing or sight—only by certain elements from within the body with certain elements from without, first combined, next developed, and finally matured into actual faculties of sensation, while it is made to receive these opposite elements in such proportions relative to each other as to give these organs support, benefit, increase, receives from them sensations only of a pleasant sort, and that only when the elements from either

side flow in the organ in quantities so superior to those flowing in from the opposite side, as again to drive back those others, and to cause, by entering in these organs alone, in them repletion, stagnation, over exertion, exhaustion, fatigue, and decombination, they began to cause in them uneasiness and pain: and we may add to this invariable phenomenon that the peculiar seeming symptoms of pain, appearing at the very birth of a child, in the cries it emits, being only produced by the first mechanical efforts of the lungs to expectorate, are not yet accompanied by any real pain; nay that when later, as in a burn or a scald, a real pain is felt, which has apparently been unpreceded by any prior pleasure, there must in reality nevertheless already from the incipient heat, have been derived a certain degree of pleasure, before it rose to the intensity at which it caused dissolution and consequent pain; and that only because the pain followed so soon after, and lasted so much longer, the prior momentary pleasure, hardly noticed while it lasted, is again immediately forgotten, and the pain alone, longer felt, remains longer remembered.

Should it be imagined that a mere absence of a peculiar sensation sometimes gives pain, because the mere absence of the act of feeding seems to produce the sensation of hunger, or because the mere absence of the act of drinking seems

to occasion the sensation of thirst—because the mere privation of the sensation of warmth seems to make one suffer from cold, or the mere privation of the sensation of cold seems to make one suffer from heat,—because when, enjoying the warmth of a fire, or a fur cloak, we are suddenly turned out into the street, or stripped naked; when sipping a delicious draught, the cup is suddenly dashed from our lips; when listening to delightful music, we find it suddenly stopped; or while imbibing the rays of a reviving sun, we find it suddenly overcast by a dense cloud,—we suffer not only a disappointment but a real pain, I shall answer that in attributing this pain to the mere privation of a certain prior pleasure stopped, we labour under an illusion, an error. That while the organs of sense are expanded to the influx of a peculiar means of enjoyment, the sudden cessation of those means at the same time leaves room for the influx of other modifications, of a different sort, in such excess, as soon to cause actual pain.

That, for instance, when in the stomach hunger produces pain, it is only from the cessation of food from without poured into that stomach, leaving the gastric juices from within poured out into the same receptacle, so uncombined, so unneutralized that, for want of being consumed, they turn back upon, and begin to decombine the very coats of that stomach itself—

That, in the body, only from want of heat or cold sufficient to neutralize the radiances of the opposite force, leaving these radiances of the opposite force to act unresisted and unmodified, we suffer from their excess—

That in the senses of taste, smell, hearing and sight, when they are in full receipt of sensations agreeing with them, we derive from the sudden suspension of these sensations an irksome feel, it is because the elements from without, ceasing to flow in their organs, leave those from within, destined to meet and to combine with them in new food, unneutralized and uncombined, by their excess and rawness, to cause this sudden stagnation, repletion, and chill.

Should it be observed that certain impressions precisely while feeble—that of water while lukewarm, of food when insipid, of flavours and smells while faint, of forms while indistinct, of a tale inane and flat—occasion a species of irksomeness or nausea, which similar impressions, when more acute and pungent, again remove, I shall answer that this phenomenon proceeds not directly from the sensations which these impressions give, but from these impressions by their very feebleness still leaving room in their weak state for other different disagreeable impressions, which, when stronger, they entirely exclude.

Should it be observed that physic often already, from its very first and feeblest perception and

smack, produces violent nausea, I shall answer that this proceeds from that physic being intrinsically composed of elements so different and acting on papillæ of taste and smell intermixed with each other so different and yet so closely wedged together, that the impression produced on each sort of papillæ, which, if produced separately might longer have remained pleasant, when falling on these different papillæ simultaneously, almost immediately and from the very first, causes the action of each to struggle with, and be impeded by, and cause irksomeness in that produced in the other.

And should it finally be observed that after a peculiar pain, a relief from it renders the subsequent pleasure more intensely felt, I shall say that this only arises from the interval of pain causing the elements from within, calculated by combination with elements from without to produce that pleasure, while the pain lasts to remain so suspended, as afterwards to flow on unexhausted in greater quantities than they would have done, if not made for a time thus by stoppage to accumulate.

CHAPTER XXIX.

Further continuation of the preceding chapter.

HAVING thus I hope proved that all sensations, as they begin by being beneficial, also begin by being pleasant, and only when carried beyond a certain pitch, become both detrimental and painful, I shall now continue to give instances that only those same elements which, when meeting and combining in certain relative proportions, produce good, benefit and happiness, when in certain other different relative proportions meeting and combined, produce all the evils and miseries of this world.

Thus should in the organs of sense and mind, of certain external modifications, of which the influxes and impressions only carried to a moderate degree leave a recollection capable of nourishing the mind, and consequently, of giving it pleasure, be received influxes and impressions, carried to such an immoderate degree, as to have a recollection capable of wearing out that mind, they will cause in the mind those mental sufferings called passions, and even, through the reaction of the mind on the body, in that very body cause those injuries, disorganizations and con-

sequent bodily sufferings, which are experienced in consequence of desires, whether called lust, love, ambition, avarice, or anger, hatred, envy, jealousy, fear, sorrow, or others, carried to excess without being gratified, or even when immoderately gratified.

And in the same way as in single individuals, so in bodies corporate, should those same feelings which, in certain proportions relative to each other, contribute to cement, support, extend and develope the different component parts of the community, exist in proportions relative to each other so different that some overpower and others yield to the remainder, they will in only of that community cause the gradual weakening, decline, overthrow, undermining, evil, unhappiness and decombination.

Should in a social state, of whose formation the object is not only the acquisition of means of enjoyment beyond what can be attained by the members in their state of nature, but also the increase of the power of protecting and securing those means of enjoyment acquired, an overweaning anxiety respecting this latter object, cause the former to be eclipsed—cause the means of defence so to preponderate over the means of production, as to make this social state resemble that of ancient Sparta,—what will be the consequence? The excessive anxiety to promote the arts of war and destruction will cause the advancement

of the arts of peace and production, by which ought first to have been reared things worth defending, to be so neglected, that not only the nation will produce nothing worth defending, but will for a time vent its unoccupied and exuberant leisure and strength in aggressions and inroads on the peace and tranquillity of its neighbours, and will next fall into such anarchy and dissension at home, that when their neighbours retaliate the evils suffered, they will find them an easier prey, than, by a proper balance between the arts of peace and of war—of production and of destruction—they could possibly have found them.

Or thus again, should in a state the accumulation of money, the mere representative sign, and not even of the objects most valuable to a community—namely, valour, public spirit, patriotism, and zeal for its welfare and defence—be so exclusively sought, that, in the ardour to heap up pelf, the acquisition of all the higher qualities, not capable of being estimated in hard coin, be forgotten—that money became the only wealth thirsted for, and the objects exchangeable for hard cash the only things valued—that venality be the only feeling fostered, and gold the only god worshipped—this preponderating anxiety only for a few of the means of enjoyment, that neglect of others more extensive and more permanent, will cause the state, like ancient Car-

thage, early, by weakness and corruption, to become a prey to all the calamities from which plenty of money is considered the surest ægis and protection.

Thus should in a community, as at Athens, the dislike to despotism, the love of liberty, the solicitude for equality of rights,—to a certain degree commendable qualities,—rise to such a paramount height, as to cause a mistrust of whoever, by his rank, or wealth, or talents, or public services had distinguished himself in the least from his fellow-citizens, and might, by possessing their confidence, gain over their minds any sway; should this distrust immediately make them discard such a man, banish him, deprive the country of his talents and services; only give their confidence to the meanest of the mob —to common informers, and to low and ignorant ruffians,—instead of the community gaining by this proceeding additional general equality and liberty, it will only cause the persons wisest and most interested in the welfare of the state, those most fit to rule it, to become slaves to the yoke, the whims, the tyranny of the most ignorant, and capricious, and changeful, and selfish dregs of the community.

Should in a state, as in ancient Rome, the interests of a few patrician families so preponderate over those of the community at large, that the multitude at last became by famine goaded on to rise against the few, and that these few, in order

to defend themselves against the many, were made, instead of trusting the defence of themselves and their country to its citizens at large, to trust their own defence against the very citizens themselves to a small band of hirelings, these venal troops would soon use their power to lay the law alike to the plebs on one hand, and to the patricians on the other, make and unmake emperors at their pleasure, and leave a ruthless prætorian band, without law or control, the sole despots of the commonwealth.

Should in a state in which the arts of utility and comfort ought ever only out of the exuberance of the means they supply to produce and support the arts of luxury and ornament—from the mere vanity of its rulers—so many heads and hands, minds and means be, from the production of objects wanted for use and comfort, diverted to the production of objects only of luxury and ornament, as still to increase the scarcity of the former, this premature solicitation to that for which the soil is not yet ripe, instead of advancing, will only retard the general welfare of the community; will only produce premature exhaustion, debility and suffering. It will, in the anxiety of procuring to the few superfluities at a cheaper rate, render to the many the necessaries of life less accessible. It will, instead of causing the symptoms and the overflow of real wealth, only cause the deceptive glitter of gilt poverty. It will produce, instead of those fruits

abundant, and rapid, arising from a soil well prepared, only those unsubstantial, ill-flavoured abortions, swelled up through dint of mere water, which, without ever acquiring real ripeness, only fall into premature decay. It will thus, instead of increasing and forwarding the lasting welfare of the country, be a check upon its advancement, make it retrograde in means of general weal, and substitute to the solid support of universal happiness, the appearance of a phantom of prosperity, which, as soon as examined, crumbles into dust.

Should on the other hand, in a commonwealth, in which the arts of necessity and utility have been carried far enough to be able, with a proper distribution of the means that vivify them, to produce and to give unto all the inhabitants every object of utility and comfort wanted, after these arts are thus made to attain their full maturity—from the effects of an atmosphere so dense and damp as to intercept the finer impressions of the senses of hearing and sight, or of a soil so saturated with coal and so surrounded by sea, as to afford fuel too plentiful for the production and exportation of objects of mere mechanical industry, or from some other cause,—in individuals the sense and mind become so clogged and callous to the stimuli calculated to rouse them to the higher pursuits of the fine arts, as to retard in the wealthy the

inclination to afford the poor, by commissions for their production, a means of subsistence, and in the poor, by the want of such commissions, the means of exalting their pursuits and their ideas, and in both, the refined enjoyments that must arise from the production and contemplation of such works, this delay, this sluggishness, when the former species of industry can no longer alone answer the full object all industry is intended to promote, in the production of that new and higher species of industry, which in the natural course of human developements ought to have arisen out of the former, alone become insufficient, will not only prevent the arising of a great many goods, such as in the rich, an increase of legitimate and laudable pleasures, and in the poor, an increase of legitimate and laudable, and ennobling means of subsistence, and in the country at large an increased stock of those productions calculated in all classes to augment enjoyment, emulation, respectability, refinement of ideas, public spirit, patriotism, and claims on the esteem, admiration, and respect of foreigners, all which the cultivation of these higher objects would have produced, but, in as far as in this world nothing can stand still, nothing remain stationary, and whatever does not advance must needs retrograde, this baneful torpor will, by causing in some channels of wealth the influxes for want of issue to stagnate and corrupt, and

in other channels these influxes to run waste and be lost, produce in the community the seeds of incalculable positive evils and sufferings.

Of the members of the community who, gifted with means to afford the poor, in commissions for works of art, an employment both more lucrative and more exalting—more certain of keeping them from want and starvation, and of ennobling their minds—fail in inclination so to do, some, of a totally inert disposition, will only suffer their inflowing wealth from their hands to relapse in their coffers, and there to return to the state of entire inactivity and absence of circulation and productiveness, in which the gold lay first buried in the mine; others, goaded on by ennui, will try to cast off their tedium by the opposite extreme of giving their wealth, through the process of gambling, a circulation so rapid, as to leave it no leisure to become productive of any desirable fruits, and only, while reducing the loser to despair, to procure in the winner a mere momentary and feverish joy; others again will endeavour to beguile their listlessness, by wasting their superfluous wealth, according to their different dispositions, in various intermediate ways, none so wholly hostile to all good purpose as the former extremes, but all still inefficient to that of producing happiness.

Some will, under a mistaken notion of manliness of taste and pursuits, riot in drunkenness,

in debauchery, in debasing pastimes, in feats only calculated for the applause of the lowest rabble, in endeavours not to exalt their taste, manners, and language, but, by bringing their pursuits down to the level of those of their menials and dependents, to become the scoff of their own grooms and postilions. Others will, under an idea of dignity of demeanour equally erroneous, consume their wealth in empty, unsubstantial, hollow ostentation and show; in keeping a silly state, in maintaining, at an expense which might have supported a number of artisans and their families in employments honest, industrious, and calculated to enrich, improve and ennoble themselves and their country, a number only of useless and servile sycophants, servants, hounds, horses, equipages and retainers, only fit by their idleness and corruption to spread contamination and vice far and wide; others again, under the notion of greater elegance and refinement of taste, will exhaust their means in pursuits still more effeminate—in the encouragement of productions of mere frivolous fashion, no sooner acquired than, even before they have had time to lose their first bloom, already by their inanity palling upon the sense, and again discarded for other productions equally inane, of which the rapid rotation, while wasting the means of the purchaser, ensures not the support, or improves not the intellect of the maker, but only causes the latter, by alternate

sudden overabundance and as sudden lack of employment and wages, to pass as rapidly from the utmost heights of improvidence, intoxication, insolence and profligacy, into the utmost abyss of misery, starvation, despair and crime. Nay all the wealthy alike will, from the debasement of their mind, and from the disproportion between the real worth of different things and the imaginary value they set upon them, acquire for mere gold—in itself only a glittering substance, without intrinsic means of procuring happiness, or even pleasure—a thirst so inadequate to the real portion of felicity gold is able to afford, as to destroy all public spirit, all patriotism, all regard for integrity, virtue, and whatever else supports and strengthens a community—as to substitute to these mere venality, corruption and a spirit of jobbing—as to cause every thing in the country —the seat in the senate, and the privileges of the pulpit, the right of defending the interests of man, and the task of inculcating his duties, like the box at the opera or the concert—like the shake of the stage dancer, and the quaver of the soprano—only to be deemed worth what they will fetch in the market; and as to make the highest orders of the community, instead of being those most solicitous for the public welfare, those precisely most ingenious in sacrificing the public good to their private emolument.

Nor will those other members of the com-

munity who, only gifted with powers of head and hand to earn a subsistence, when the productions of mere mechanical arts are raised in sufficient quantities to satisfy all, require the cravings of the wealthy to entice them to the production of things at once more exalting and more lucrative, and which, without this spur, their habits would not have induced them to try the success of, little as by this dilatoriness in pursuing higher aims, they have to lose, of that little lose less. They will, in despair at no longer by their mere mechanical labour earning the wonted subsistence, cease their toil, fling away their tools, break their machines, give up the possibility even of resuming their former occupations, if they should wish it. They will, for want of being able to take to higher employments, in their forced idleness, while they retain some fear of those above them, doggedly receive, or extort from them an arrogant, a forced, and a degrading charity; and, when by the daily sight of the wanton way in which the wealthy part of the community spend their means, and the contrast thereof with their own misery, they at last are made to lose all regard for laws, from which they only reap an inadequate advantage, will avail themselves of their superior numbers, resort to rapine and to violence, and destroy all the means of enjoyment of the rich, without adding much to their own felicity.

The very palliations by short-sighted ministers resorted to, in order to prevent these dire effects of disproportion between wants and means, without striking at the root of the evil—drawbacks on goods exported, the importation of foreign productions prohibited; new machinery invented to render mechanical industry, already too rapid, more productive; canals and rail-roads traversing the soil, spread over its surface, to render the circulation more easy and rapid, where unaccompanied by any means of fomenting a general craving for the production of the higher works of art, not yet existing,—will only accelerate the effects of the growing evil, and render the explosion more awful and more terrible. In the midst of a land covered with wealthy and industrious cities, surrounded by seas, on which ride fleets leading to wide extended and flourishing colonies, will the whole social system, for want only of a proportionate distribution of, and balance between its means of enjoyment and prosperity, inevitably fall into the extremes of disorganization, ruin, misery, and suffering.

CHAPTER XXX.

When on this globe evil first began, and how it gradually increased.

I HAVE shown that those very forces and elements which, in certain proportions relative to each other, are made to combine and produce good, in certain other different proportions relative to each other, are again made to decombine these former combinations, and to produce evil; that evil only arises from the excess of certain of the elements of good.

People in general apprehend that on this globe of ours all began by being unmixed good: that as soon as any rational entities arose on it in the character of Adam and Eve, unqualified virtue and happiness arose with them: that on this globe the destination of man first was to live on for ever, exempt from evil, from decombination, from suffering and from death; that only after Eve yielded to temptation and to sin, evil, and with it, the doom of mankind to misery and death, began as a direct punishment of Eve's offence.

I cannot suppose this to be the right inter-

pretation of the scriptural text. I cannot believe evil to have been a consequence only of an act of Eve's. I rather imagine Genesis only meant to describe both Eve's sin and subsequent death as successive effects of a cause already anterior to Eve's offence, nay to her very birth; that her misdoings, her sufferings, and those of her progeny, arose from an impulse given prior to her existence to the movements of this globe, in which all Eve's actions, wrong as well as right, necessarily bore their share.

If, as I have in the foregoing chapters attempted to prove, all in the universe begins with elements of combination and good, but if at the same time, from certain of these elements of good themselves being in certain points of time and space relative to each other in proportions uneven and ill balanced, must already early have arisen partial evil, it is probable that some such evil had already arisen in this universe prior to the first creation of this globe, since the very deflection of gravitation, which was the cause of this globe offering an individual form distinct and separate from that of more central worlds, and the very irregularity of the later movements of this globe, which arose out of that deflection, indicate some such prior irregularity, and would suffice in their turn to account for all the later irregularities, evils and decompositions to which this globe has since been subject.

And in fact that the sources of evil already existed in this globe prior to the formation of man, seems by scripture itself, in its figurative way, acknowledged, first in the account of the angels rebelling against God, and next in the allegorical planting in Paradise of the tree of knowledge of good and evil, previous to Eve's offence, which implied that already previous to that offence there existed roots not only of good but of evil: inasmuch as no knowledge can be conceived except of such attributes as already exist.

Without however dwelling on the first physical causes of all the various evils, physical and moral, which have since befallen the small part of the system of the universe, composing this single globe, I shall only try to give a short sketch of how the principal evils, physical and moral, commencing long before the surface of this ball was sufficiently matured to bear rational, or even sentient or living entities whatever, by degrees developed.

Some people trace the havocs of which this globe shows the early traces entirely to the preponderance of heat, and thence have been called Vulcanists: others trace them wholly to that of water, and thence have been called Neptunists.

Each sect seems alike to have forgotten that both fire and water are only different modifications, each composed of many different simpler prior elements—such as time, space, gravitation centripetal and centrifugal, electricity, substance,

&c.—and that consequently of some of those prior component elements there must thus somewhere in time and space already have been a disproportion, an irregular distribution, a preponderance, before there could be any disproportion either of fire or water. Each sect has failed alike in perceiving that, at whatever period, and in whatever place the preponderance of either fire or water began anywhere, it could not have continued very long, ere a preponderance of the other modification also began in some other different place; since if, on the one hand, here we see on the very tops of the highest mountains the remains of immense strata of aquatic productions, which could not have been formed there if water had not at some period covered the surface of this globe;—if here we recognise water itself as a necessary agent in kindling up subterraneous fires and causing earthquakes and volcanoes, and stumble upon enormous decombinations, recombinations, congelations and crystallizations, produced by the mere agency of water,—there again we find certain substances very primitive and general, such as quartz, feldspar, and other calcareous, sulphureous and bituminous, insoluble in water, which can only have been combined by heat and fusion. Since other substances, like granite and trapstone, though in many places since made to pierce athwart, and to protrude beyond the stratified

rock, must yet originally have been formed and situated immediately above the region of pure metals, out of whose elements alone they can have first been composed by mere fusion; and seem only on these beds of metals to have arisen from seas first formed at the surface of this globe having subsequently penetrated to its metallic nucleus, and there having recombined part of its oxygen with part of these metals in the form of these granites, which only by the same heat that combined them, were made to boil over, and in their turn again to break athwart their later superstructures; and since there are later lavas, basalts, porphyries, nay pyrites, again found enclosed in larger bodies, by earlier fires composed and thrown up, and since those very stratified rocks, first by water combined in a horizontal position, have later in most places been cracked, lifted up and placed on edge in a vertical position, by the force of those very fires from within, by which the cracks produced in those strata were, under the name of metallic veins, filled with ore; and since, besides those earlier subterraneous fires of which we still every where on this globe recognize the traces, we still in numberless places see actual manifestations of such internal fires, in volcanoes to this day remaining in full activity.

That however on this globe no central fire was kindled, and was left to this day to diffuse

throughout its mass a general heat outward, appears since the deeper we dive in the surrounding seas and lakes, the colder the water feels.

That while the sun of our system, though already in its capacity as one of the many later and more partial secondary worlds, it already probably has a density much greater than that of other more primary globes, is still four times less dense than this globe of ours—that this globe of ours from the oblique pressure of centripetal gravitation acting from without upon it, and from the oblique counter-pressure of centrifugal gravitation only from within its centre reacting outward, is become so dense, as to have left the elements driven to its interior in complete immobility and inertness, and to have caused all further combinations and decombinations to be confined to its mere external crust, is proved not only theoretically but practically, by its external surface appearing subject to no changes such as would have arisen from internal circulations very deep seated and very general. The very deepest source of the earthquakes convulsing its external crust, and of the eruptions and volcanoes that rend its external surface, are not calculated to lie more than, so to speak, skin deep. Still are we unable to reach even as deep as the origin of these disturbances; and the more continuous internal masses and reservoirs of those

metals of which they show, and we so anxiously explore, the outermost overflowings and veins, will perhaps never by the utmost avidity of man be reached.

That only by later successive showers, coming more remotely from surrounding space, and more proximately from our own atmosphere, of elements and substances similar to those that formed the first nucleus or earlier strata of this globe, its later circumference was enlarged, appears from the mode even, parallel and horizontal to its first nucleus and to each other, in which these later strata seem to have been formed and consolidated, before by later expansion by fire from within they appear again in many places to have been broken, disturbed, and placed on end.

That after certain strata of substance had by pressure from without been consolidated, of these strata parts were from within, by the expansive force of centrifugal gravitation, of electricity or of heat, again made to rise up in vapour, and with fresh showers of different elements from on high to mix, before this mixture was again made to collapse and consolidate on the former strata, appears since often between two layers of substances wholly different from each other, appears an intermediate layer, composed partly of the substance underneath, and partly of the substance above it.

That the materials which now compose the highest apices of the highest mountains, protruding from the face of the globe, once formed the general and continuous bed of the seas that enveloped the whole surface of the earth—that only by tremendous subsequent partial and oblique pressures upon that surface were caused the deep scoopings out of some parts, and corresponding elevations of others, appears from the very tops of the highest Alps all round this globe having formed the habitations of testacea, and consequently having once been immersed in water—the remains of such animals having been discovered by Ulloa in immense strata in the Andes at the height of fourteen thousand feet, and by Wells in the Himmaleyans at the height of sixteen thousand feet above the present level of the sea.

That formerly this globe was situated nearer to other planets and to the sun—that with the other planets it once formed round that sun, their common parent, a group or circle closer than it does now—that by the centrifugal gravitation diverging from the sun these latter bodies, while intrinsically by degrees enlarged, were also gradually extrinsically driven further from that sun, and from each other, appears since our globe shows the marks of having formerly received from that sun more heat, and from other surrounding bodies greater pressure, than it receives now.

That formerly this globe received from the sun more heat than it receives now, appears from the remains of such vegetables and such animals as now only thrive within the tropics, being found in regions near the poles; and that formerly this globe was nearer to and more pressed upon by other surrounding planets than it is now, appears from every part of its surface, showing ribs formed of those primitive alpine mountains which, very different from the lesser and more unconnected and irregular secondary eminences, are seen to run at immense and even heights, to immense distances, in rows parallel to each other, all more slanting on one side and more abrupt on the other, and thus seem the remains of immense waves, which, while the surface of the globe was still more generally liquid than it is now, were produced at that surface on a grander scale by occasional pressures more powerful than, but similar to, those which still are on a lesser scale periodically produced in the waters of the ocean and of other seas, by the pressure of our moon on our atmosphere, and which still, though only the miniature of the former elevations, are called waves.

It is when of these gigantic turgescences, by the violent pressure of other globes on ours, while still in a liquid state, produced, the more aqueous and liquid component parts had again, by the subsidence of that pressure, been left to roll

back in the intervening hollows, that in these hollows between one wave and another were formed those inland seas and lakes which still remain, while of these waves themselves the more solid materials subsided in the sharp intervening crests which divided one valley and sea from another.

That where, of the waters first continuously covering the surface of this globe, a part had thus, by the pressure of surrounding planets, been buoyed up and retained in hollows formed at a great height above the general level, a part were again by their weight and fluidity made later to break through the banks that surrounded these elevated hollows, and by degrees to find their way down to the general level, appears in the series of basins now partly dry, which, beginning in the highest ground in the interior of Asia, in the sea of Baikal, thence through the lake Aral, through the Caspian, the Euxine, and the sea of Marmora, the Archipelago, and the Mediterranean, and through the intervening steppes or straits, at last led their waters back into the general reservoir of that ocean which surrounds, and from whence gradually rose all the continents of the globe.

That besides the general pressure of the sun, and of other surrounding planets, which caused great alterations in the first forms of our globe; there were other more partial pressures—of

some planet or comet passing very near our earth—which caused great subsequent disturbances in its original movements, and rendered its rotation round its own axis, from first being perpendicular to the plane of its rotation round the sun, subsequently oblique to this latter, and the cause of all the present irregularities in the temperature of its different parts, appears since this irregularity of movement seems as far as we know peculiar to itself, and appears to date from some sudden change, that only took place long after its surface already bore vegetables and animals, inasmuch as it produced the sudden destruction of many such organic productions, living prior to it in northern climates, similar to those which at present can only exist in climates nearer the tropics.

It is a very general opinion, that where now are seen, rushing along the bottom of deep glens and ravines, roaring torrents, these torrents themselves first gradually excavated those channels, through which they have since pursued their course. But this I do not believe. I believe that fire first produced these disruptions and fissures, through which water was subsequently made to circulate; and that in the same way as in those crevices formed underground metals liquified were made to flow upwards, in those chasms formed aboveground the waters from without were afterwards made to flow downwards,

because the water flowing in those hollows in general seems totally inadequate to the labour of scooping them out, and because those fissures retain in their channels those sinuosities, those angles, those correspondences of sharp alternate projections and recesses, which are the effects of sudden disruptions by fire, and could not have remained in excavations by water; and because, finally, we find not in them those partial accumulations of alluvial soil, found where detritus by water has evidently taken place.

That these and other dire convulsions and havocs already on this globe took place in the materials of the mere mineral creation, long before its surface was ready to receive living entities, we see every where in the traces of them still subsisting, where no relics exist of any organised beings.

But that, either by these convulsions themselves causing the elements of entities to be remixed in a more intimate manner, or by new elements from higher regions successively supervening, and remixing with the wrecks of former and simpler substances, were subsequently produced entities organized and living, vegetable and animal, we likewise see.

Nay, we see that of these organic productions the earlier and simpler species seem themselves to have been the scaffolding on which arose the later and higher ones: that living entities, yet

destitute of organs of sensation, preceded, and in part caused, sensitive ones, of which we only find the first traces after and above the insentient ones; and that of those that received organs of sense, the mollusca preceded the fishes; these the saurians, and reptiles; these the quadrupeds; and these again man.

Nay, we even see, that of these organic productions, some again became developed to an immense degree, and got so much ahead as, by consuming all the materials of life, to preclude the formation of other higher sorts, until by later revolutions their forms and faculties were again destroyed, and their elements set afloat; since we find in different places remains of gigantic mollusca, and reptiles, and pachydermata, and other animals, again entirely swept away from the face of the globe, and having made way for other higher species, even before the creation of the last and highest of earthly productions, man, had begun.

That man, formed out of a remixture of various elements more complex than any brute, arose last, appears since among the many vestiges of antediluvian brutes which we have found, none yet of well-authenticated antediluvian human beings have yet appeared, although we know that after man arose on this globe, it has still frequently been visited by very general destructions, both from water and from fire.

That learned men, in asserting nature, un-

mindful as she appears of the preservation of individuals, to be more careful of that of species, are equally wrong, is proved by the number of species, entirely destroyed, of which the remains are daily brought to light.

That on this globe the decombinations, evils, sufferings, and deaths, corporeal and mental, already long before man arose very frequent, must still, after man's creation, have in intensity and extension infinitely increased, appears since in man the organs of sense and of mind, in number, variety, developement, and closeness, infinitely exceed those found in any brute; and since, as on the right and moderate excitement of these organs depend the enjoyments and happiness of existence—notwithstanding the famous saying of Shakspeare, that the worm, in death, experiences pangs equal to the giant—on the wrong and excessive excitement of them depend the sufferings and miseries of existence.

That even of the human species itself the subdivisions, by natural organisation, or by later cultivation, education, and developement, carried only to a less elevated pitch, still remain only capable of sufferings of body and mind less acute, than those species and individuals by nature or by art more developed and refined, whose organs of sense and mind, consequently more ample and close-wedged, sooner suffer from extremes of excitement, appears since the

negro and the Samoyede are, from heat and cold, hunger and thirst, dentition and parturition, and other physical impressions and processes incidental to humanity, still apt to suffer so much less than higher tribes, as not yet to dread even those pains after Eve's offence peculiarly denounced against her, and which therefore alone already mark her as an individual, no longer of the more inferior, but of the last and highest human tribes; and since, unaided by the suggestions of philosophy, the negro bears surgical operations with a degree of insensibility, of which all the pride of stoicism hardly enables the white man to assume the appearance; nay since not only Hottentots and other savages envelope their bodies with the putrid remains of the carcasses they feed upon, without being annoyed by the nausea these produce, but even the lower and less educated individuals of higher species receive not yet any annoyance from those offensive tastes, smells, sounds, and sights, which are sufficient to torture senses refined and more delicate.

We admire, in the lower orders, that comparative resignation and courage with which they face the loss of children, of limbs, and of life. We wonder at the coolness shown in battle by the common soldier or sailor, who have not to feats of heroism the excitements felt by the officer. The truth is that in the former this indifference to danger and death proceeds from the

fewer permanent goods they have to bid adieu to with life; and that the pleasures they leave behind, cause in their less excitable mind a less acute regret. The sailor, with ties in the past less numerous, less forcible to tear asunder, feels, on dying, with regard to the future none of those doubts and misgivings, which, founded or not, affect those whose views, both one way and the other, are carried further. The crude, indigest, and confused ideas of fatality—that is to say, of the necessity of certain ultimate events taking place, wholly independent of prior efficient causes,—still to a certain degree clung to by all minds naturally apathic or little cultivated, —still screens the sailor from those fears respecting the future, which, at the awful moment of taking leave of all the past, fill with apprehension minds more voluble and more sensitive.

In the lower orders, who have less to regret, resignation to death cannot yet imply that high attribute of moral courage, which it may proceed from in higher individuals, who, possessed of and appreciating to the full all the enjoyments of life, yet prefer the loss of these blessings to that of the esteem of the community.

In a body and mind, both by nature finely organised, and by art highly cultivated, sufferings, in their lowest degree, beginning in the effects of an atmosphere somewhat too hot or too cold; in a pillow somewhat too soft or too

hard; in a flavour or odour somewhat too flat or too pungent; in a sound somewhat less cadenced; in a sight somewhat less metrical than had been anticipated; in a dish by Very; a cadence by Veluti; a pirouette by Vestris; and a quantity by Virgil *manqué*, may rise in a progressive climax to the last and highest torture both bodily and mental, of which the bare mention would freeze the soul with horror.

CHAPTER XXXI.

In man alone arise those sufferings, first only beginning in the feelings of the mind, which are pre-eminently called passions.

MAN is not only liable to feel even the sufferings beginning and ending in the sense, of which brutes already have their share, much more acutely than any brutes can do; he is, moreover, and he alone, liable to feel those sufferings first beginning in the mind, in the recollections of past sensations alone, of which brutes feel not yet the most incipient degree; and which, arising from the idea of certain past external objects and sensations, and the desires by these produced of similar future sensations carried too far, cannot be satisfied, or even in the very act of gratifying them, prepare the way for later fresh mischief, physical or mental.

Thus man alone is liable to a recollection or an idea of the charms, bodily or mental, of a peculiar woman, and to a desire of enjoying those charms of body and of mind too powerful and too exclusive to allow him to remain sensible to the charms, physical and intellectual,

even of other women, equally great, equally calculated to gratify his feelings, and more easily attained; and thereby not only neglects enjoyments which he might have possessed, but if he cannot obtain the peculiar woman he wishes for, suffers from his unsatisfied desires pangs of mind, and through the reaction of the mind on the body, even bodily pangs, languor, loss of appetite, emaciation, consumption and disease; nay often, even where he can obtain the peculiar woman he desires—can gratify his lust or love for her—is liable to do so in such a mode and degree, as to prepare for himself new sufferings of body and of mind, even greater than those he escaped from.

Thus man again is liable to vent his anger in acts of irritation and revenge; his thirst of power, of pelf, or of praise in acts of ambition, cupidity, avarice, or vanity, with a degree of eagerness and avidity beyond all proportion to the enjoyment which these acts can afford him, even when successful, and which, if they are unsuccessful, is apt to make him repine at disappointments entirely fabricated in his own mind. He is liable for past pleasures lost to feel so much regret, so much grief, so much sorrow, as to become insensible to future pleasures still in his power, and which, if enjoyed, might have filled up all his time with happiness. He is liable to apprehensions, fears, suspicions, jealousies and dis-

trusts, beyond what external circumstances warrant, and which, while they continue, torment not only his mind, but by their reaction on the body, even wear out that body itself. He is pale with fear, flushed with anger, palpitating with jealousy, yellow with envy and bile. According as the ideas formed are those of objects of fear and of aversion, they cause the nervous fluid to be in the brain chilled, and from the external muscles through the nervous ducts retracted inward, and these muscles themselves to collapse, and the blood in them to ebb away, and the body to become cold and palsied, and the external roots of the organs of sense to appear fixed and drawn; and according as these ideas, on the contrary, are those of objects we desire to grasp, to lay hold of, and to master, they cause the nervous fluid to effervesce, to overflow, to rush outward, to be through the nervous ducts propelled to the muscles, to be made in those muscles to increase the flow of blood, the flush and the heat, and to give to the external roots of the nerves situated on them orgasm and tension. Nay, by the violence of his passions man is made to lose his presence of mind, and impelled to commit, in order to fly from his torment, actions preparing for the organs of sense and intellect other torments, even greater than those he flies from. The man frightened will, in order to vent

his fear, rush down a precipice; the man in anger will, in his fury, stamp till he has crippled himself against an insensible stone; the man jealous of his mistress's love will fret, fume, and tease her, till he has at last won her hatred.

And not only single individuals but bodies corporate, entire communities, are liable to certain passions, such as those of avarice, ambition, envy, jealousy, animosity, revenge, rivalry, and others, which often carry them beyond all bounds of reason, and, by depriving their mind of that equipoise which of every measure permits one to calculate the advantages and disadvantages, make them commit the very faults for which they blame their adversaries, and incur the very penalties which they would wish these to suffer.

CHAPTER XXXII.

Vis medicatrix.

Forces, elements and substances during a certain period, and to a certain distance impelled with such intensity, as not to be, by forces, elements and substances from the opposite side impelled, resisted and balanced, but to overpower, and to drive these before them in progressive accumulation, go on moving and acting, till at a later period and in a further place by their own expansion weakened, they are by the opposite elements, forces and substances, in consequence of the corresponding pressure, condensation and accumulation these experience strengthened, again in their return resisted and overpowered.

Thus of gravitation centripetal, of which a certain portion, driving a globe to another larger globe, threatens to make the former collapse on the latter, another portion, from the latter globe again made to recoil, and to become centrifugal towards the former, will, by its counterpressure and resistance, again prevent that former globe from approaching too near the latter, and cause it to be by that latter repelled.

Thus of heat a certain portion, in a body by cold solidified penetrating, confined and accumulated, till by its pressure from within that body on its surrounding envelopes, it distends and dissevers these inclosures, and is again by them let out and left to evaporate, will by the very excess of its strength lose that strength, and again, as it again spreads further, proportionably weaken.

Thus the water, in a hollow receptacle accumulated to a height at which it prevents vegetable and animal productions from breathing and growing, and annihilates all those that in it existed, at last by its increasing weight breaks the very barriers to whose resistance it owed its forced elevation, and not only overflows, and over a larger expanse exerts less weight, but perhaps even causes in that larger expanse, by greater diminution of its density, the arising of that fertility which its excess had before over a smaller expanse prevented.

Thus when certain influxes from without are in certain parts of a body vegetable or animal, in whom their circulation ought to produce support, growth and welfare, stopped from advancing, they by that very stoppage are round the diseased spot made to accumulate in a ring, whose vitality by this accumulation heightened, at last penetrates to and again causes the sore to heal.

Thus after cold, from without penetrating too partially or too powerfully in a living body, has caused its fluids to condense till they are prevented from circulating through that body, and leave it impoverished and feverish, the internal heat by that surrounding cold condensed and strengthened, will at last in its turn again acquire over the surrounding heat such preponderance as to break through it, to drive it out in the shape of a profuse perspiration, and to re-establish the former absorption, circulation, nutrition and health.

Thus after substances intended for nutrition have from without been taken into the stomach, in quantities beyond what the gastric juice, from within the body poured into that stomach, can encounter and can decombine, and have caused in that stomach food to accumulate undigested till it oppressed and sickened that viscus, this very accumulation, by stopping the efflux of gastric juice, will cause this latter also to accumulate till it lifts up the undigested food, causes it to be thrown off upwards or downwards, and relieves the stomach of its load.

Thus after certain impressions, through the sense produced in the mind, have in that mind by their intensity occasioned passions, and sufferings mental and bodily, these very sufferings will in their turn leave recollections calculated

to make us guard against the further reception, indulgence and cherishing of such ideas, as may occasion the recurrence of similar sufferings and passions.

Thus in bodies corporate, in entire communities as in single individuals, either the experience of past effects of passions will serve as a lesson for the future, or the passions will at last consume their own fuel, and thus evaporate, and leave what remains of elements of feeling to be recombined in a shape less inflammable, more solid and more lasting.

And thus not only all modifications of mere nature, but all those of art, after they have arisen to a height so disproportionate to that of the opposite modifications, calculated to resist them, and with them to produce new combinations and new goods, as thence to produce evil, by that very excess and stoppage of other opposite modifications, cause the sources of these latter through dint of repose and accumulation, in proportion as the former by exhaustion weaken, so to strengthen as in their turn to overcome these former ones.

And this tendency of the sources of evil themselves to contribute to later good, is called the vis medicatrix, and, already by nature itself in all its modifications implanted, has by art its powers more concentrated, and rendered more

speedy and more effectual. All art, on this globe, only invented for the purpose of correcting or improving certain deficiencies of nature, may be called a ramification of the vis medicatrix.

When man by artificial heat or coolness, by stoves and by ventilation, by clothing and brick walls softens the impression of the outer air on his body, he employs the vis medicatrix. When he renders a soil too humid, by draining, or too dry, by irrigation, or too tardy and scant in its productions, by manure, more fertile and fitted for agriculture, he resorts to the vis medicatrix. When he employs cookery to render crude meats, by warmth and condiment, more wholesome and more palatable, he uses the vis medicatrix; and when he recurs to sudorifics and cathartics, to tonics and to emollients, to plasters and to bleeding, in order to remedy the disproportions more transient or more lasting that exist between the different elements of his constitution, he only relies on the vis medicatrix in a more pointed manner. The social compact and all its rules and regulations, all its laws and penalties, all its punishments and its rewards, all that is intended to repress what is too active, and to promote what is too sluggish, are but effects of the vis medicatrix.

It is, however, true, that of individuals the

period of existence and the sphere of action are on this globe too limited, always to give this vis medicatrix time to reach them, before the evil under which they labour has removed them from this world.

CHAPTER XXXIII.

For entities that die on this globe there is another and a better world.

We have seen in the last chapter that on this globe there is a tendency even in the elements of partial evil to produce a return to later and more general good; that the very elements which, by a more transient and less balanced combination, produce evil, ever approach a state of later recombination better proportioned, better balanced, in which they produce more unmixed benefit. Yet must it be confessed that on this globe, in which each peculiar genus of entities, unto the last and highest, that of human beings itself, still remains divided in lesser portions, or in individuals simultaneous and successive, each in time and space distinct from the rest, and each singly, in consequence of that separateness from the remainder, only possessing an existence very limited in extent and in duration,—each called away soon from this narrow scene of action—the elements even of good themselves, by their disproportionate quantity, produce in different individuals sufferings of body and of mind very dire, before they find time to be, by the vis

medicatrix, recombined in those relative proportions more even and balanced, which again reconvert them into means of felicity: that often, moreover, this subsequent good, arising out of their more even recombination, only takes place in a period of time so much later than, and in a point in space so different from, those in which arose the prior evil, that many an individual slips away in the interval that separates the evil from the remedy, without benefiting by the latter; that many an entity has become a martyr to the evil, without on this globe receiving the compensation of the subsequent good; that in individuals not only the later more general goods that may arise out of prior more partial evils, suffice not always to obliterate the scars by those evils left in peculiar entities, nor even, in their very scars to interpose insurmountable barriers to the recurrence of similar evils; but that often the evils gone by leave many individuals, nay many entire nations, to sink under their weight, and to disappear for ever from the face of the globe, before from their bosom arises the subsequent good—before they produce the remedy, which is again to transform their elements into so many sources of happiness.

Whatever, therefore, those few privileged individuals may assert to the contrary, with whom all goes well in this world; who, by kind nature gifted with good stomachs and with sanguine

tempers, are, besides, by their propitious circumstances surrounded with whatever may gratify the body and keep the mind in tune; who experience no privation of any thing they may wish for, or only experience such slight and transient privations as render the subsequent enjoyments doubly relished; whose tranquil imaginations, moreover, only basking in visions of delight, suffer not from sympathy with the woes of others, more than does the man who in a warm bed enjoys the storm howling in unavailing fury round his walls;—who do not even, like some of Dante's ghosts, groan under the leaden mantle of those bad spirits which not only throw an additional weight over every evil, but even damp every good of this globe;—there really is on this little ball a great deal of individual suffering, for which its dispensations afford not their immediate victims, while on it, even a tardy compensation. To many a man the storms of the day remain unsucceeded by a serene sunset; and many wretches, in the agonies in which they lived, are made to resign their last breath, without even the glimpse of a more joyful relief on this side the grave!

And is it then possible that all that, to us, began with this globe, should to us end with this globe? that all that matter which, from nothing perceptible, acquires an unfolding, a developement, so curious; that, especially, all that mind which, in that matter in its turn produced, is gradually m[illegible]e to attain such a height, such

a luxuriance, such a beauty, should only reach its soaring eminence, at last again to sink into nothing? that after already the vegetable and the brute creation have displayed their wonders, man should still, by degrees, put forth forms and faculties infinitely more exalted, only ultimately again to be, from a somewhat greater elevation, hurled back into the abyss of nonexistence? that the vast knowledge, on this globe so gradually and through so many successive centuries of toil acquired and accumulated, should at last leave no fruit but a few crumbling ashes? Is the light thus by degrees kindled into so universal a blaze, again to end in total darkness? Shall from the prosperous the cup of bliss, when most overflowing, most savoured, most clung to, be again withdrawn, and dashed away for ever? Above all, shall those who in this world have only dragged on a miserable existence, in hopes of a better lot hereafter, at last only be summoned away from this lingering life, without prospect of brighter hours to pour a balm into the wound of past woes? Shall so many physical sufferings remain without any other cure than total extinction? shall so many friends, parents, offspring, whose loss embittered this life, remain unrestored in a happier existence? shall man, finally, when comes the time for resigning his last breath, be entitled to sigh out his being in inquiring, "Why was I, without my consent, made to be, to live, to breathe, and to suffer? Why was I, by an entity

which wanted me not for its own sake, forced into an existence to me fraught with risks, with perils, with certain sufferings, which are for ever to remain unobliterated by happier times and more felicitous feelings?" Forbid it, Heaven!

The thought of a closing so awful, so sudden, to the short drama of life, could only enter the brains of such as regard, in time and space, this small, this partial globe, as the whole of the sentient creation; as an abode round which the other stars that sparkle in the firmament only serve as ornamental studs, as brilliants, which deck out its short duration in somewhat greater splendour: or, at most, these thoughts could only be harboured by him who, admitting there are other worlds in the universe, think that ours is a distinct creation, neither dependent on any of the others, nor in its turn reacting on any of these.

But the more we contemplate, both in its internal modification and in its surrounding circumstances, this globe on which we still are doomed to crawl, the more we become convinced of the contrary; the more, in spite of the vanity or the pride which makes each individual on this clod of earth consider his individual self as the pivot on which all else in the universe turns, are we obliged to own that even the highest entity existing on this globe, singly, is but, in time and space, an atom compared with—an infinitely small component fragment of—the whole assemblage,

even only of genera and of individuals, that compose this single globe: that this globe, again, and many other surrounding planets, are individually only lesser component parts of a system of which our sun is the centre and the bond of union; and that this very centre, and all the surrounding extremities of our system are, in their turn, only infinitely small component parts of a whole, composed of similar systems, in extent and number beyond all calculation and even power of thought, of which each part, unto the most minute, is so closely connected with, so closely acted upon by, and so closely made to react upon, each of the others, that the elements which have formed, and which increase this globe, only at first descended to it from, only at first emanated by, other globes, earlier, higher, and more centrical, after having for a time tarried and been combined in this world in different genera and individuals, all ultimately again, on being decombined, being again released from their weighty but confined fetters, and made to return to their primitive state of radiance, are, in consequence of the laws of that general circulation to which all the elements of this sensible universe seem subject, made to revert to the higher globes from which they first, by force and pressure on them from within, were made to emanate.

Nay, the more we reflect, the more we are convinced that, if this peculiar globe still, in its situation, its form, and its movements, remains,

even compared with certain higher and more central parts only of this very same individual system—with its glorious sun and centre—a rude and an imperfect piece of mechanism; if every where in its interior and at its surface, it still displays, between intentions announced and effects produced—between operations begun and objects achieved—between the quantity of elements from surrounding space received, and the developements by these materials effected, a woful gap, an enormous deficiency, a tremendous falling short; if every where on this globe there still appears between the period of the first elements wanted for the combination of higher developements, and the completion of these developements, a want of time and of space, which of some productions prevents the completion, and of others, when completed, again produces the speedy dissolution; if at certain times and in certain places certain entities show the seeds of perfection at which they never arrive—which by others interfering with them they are prevented from attaining; if others again maturing earlier, and attaining that greater perfection, are condemned, the moment they have reached, to lose this perfection, by the intrusion of others of the sort still later; if of certain genera of entities, certain other different genera either higher or lower than themselves, and of certain individuals of each genus, certain other individuals of the same or of other genera again distinct from

them, nay, if in each individual of each genus, certain parts, certain forms and faculties bodily and mental, again different from other parts bodily or mental of the same individual, by collision or interference—by forestalling the room which those other elements and parts want for their completion,—cause the developement of the former to be arrested, or even, after this developement had been achieved, their dissolution again to be hastened; if of the mineral creation, the excessive exuberance long precluded, and in many places still precludes, the arising of vegetable entities; if in many other places, of mere vegetables the excessive luxuriance again long retarded, and still retards, the progress and developement of sentient entities; if of lower animated entities—of mollusca, of fish, of reptiles, of quadrupeds, of brutes—the disproportionate teeming long kept back and still restricts the developement of the human race; nay, if, of the human beings themselves, the inferior sorts still in many places remain hostile to the rise, the full expansion, of the higher sorts; if, even of the human races generically higher themselves, the lower, the more inferior individuals—those in body and in mind less gifted, in faculties less cultivated, in intellect less enlightened—still restrict the room, invade the elements, and retard the progress that might be made by the higher individuals of the same genus; if in the simplest elements, like those of heat and cold,

there often still is that excess—in the meanest modifications, like those of thorns and nettles, that form—in the minutest entities, like gnats and musquitoes, that venom—which, without being of any use to the owners themselves, and without contributing to their own security or defence, enables them to do higher, and often to them harmless entities, a great deal of harm; if, in the very adjustment of the peculiar means employed to attain peculiar ends, there still often appears on this globe an indirectness, an obliquity, a shuffling, a want of definiteness and precision, which frequently makes similar means answer ends very different, and as often makes the same ends be accomplished by very different means; if, in many genera and individuals, and in these genera more in proportion as they rise higher—as each entity individually becomes composed of parts corporeal and mental more different,—so far from each part finding room for full and indefinite extension, duration, and developement, each part presents, beyond a certain point, more impediments to the further extent and developement of the other parts more numerous and varied, so that of some individuals the physical, and of others the mental faculties remain in reality more stunted than they show themselves intrinsically and abstractedly destined to be; if, after a limited extent and a limited duration, even the collective mass of the faculties corporeal and mental of each different individual

must, for want of further room, by the rise of other later individuals of the same sort, be brought to an often premature and always unwelcome close, so that the species can only be perpetuated by new and distinct individuals, rising as their predecessors fall; nay, if this very perpetuation, this very successive rise of individuals distinct from each other, each wanting in turns, for their formation, their support, their developement, their happiness, the same elements previously possessed by these others, is the everlasting source of ever shifting misery and privation to all; if a thousand wants, dependences, cravings, and clashings, and sufferings, and sacrifices, unintentional and involuntary—or even, if intentional and voluntary, not therefore the less irksome and painful—must be endured in turns by every entity, sentient and rational, young and old, husband and wife, parent and offspring; all these imperfections, all these evils, all these drawbacks, which cannot be denied, are not effects of the intrinsic nature of any of the component elements of this globe themselves—are not such modifications as these elements must have displayed at any time, in any place, and under any combination,—are not such as they must equally have shown in earlier worlds, and must again equally show in later worlds; but that they only on this peculiar globe, and on all other globes situated like this, arise from their uneven and disproportionate combination; that the evils

and drawbacks of this world only proceed from its peculiar situation in time and space making the elements, from other earlier, higher and more central globes transmitted to its site, descend to, and meet upon, and combine in the same in a manner so indirect, oblique, ill poised, ill balanced, uneven and disproportionate, as to leave it ever subject to pressures, to influxes, to circulations, to combinations, to decombinations and to effluxes partial and disproportionate, here too early, there too late, here too great, there too small, relative to others: that from these flaws and blemishes the worlds earlier, larger, more central in time and space, more equally and proportionably from all sides and in all directions pressed and influenced, and made to return the more even pressure and emanations they received, must be exempt: that these higher and earlier and larger and more central globes must, unto their inmost core, remain a scene of ever-uninterrupted heat, light, circulation, combination, life, sensation, and thought, void of the interruption or break of genera, of individualities, and of parts distinct and separate from each other, and excluding and barring out each other's junction and intermixture; and that whenever our component elements, loosened from their earthly fetters, shall, in their radiating form, by the natural circulation to which they are destined, revert to these higher and more central and well-situated and well-

balanced worlds, they shall there be recombined only in new additions to the greater individuality of which each is composed,—be in this individuality blended with its already existing parts; and causing this individuality to be increased by the elements received from all the surrounding lesser globes by it ruled, and fraught with the faculties of sense and of intellect of all these former globes combined in their just proportion—feeling all, seeing all, knowing all that passes around, without excess and without deficiency; without ignorance, obscurity, confusion, or glare—will, not only leave it exempt from all the pains and drawbacks incidental to the secondary globes over which it presides, but will, of the events and modifications taking place on these lesser worlds, give it an insight, a knowledge, a contemplation, a retrospect and a foresight, more delightful, more unmixed with pain, than any thing we can thus far conceive.

On this very globe which we thus far inhabit, the same elements that, congregated in certain proportions relative to each other, are not yet able to be combined in any solid bodies whatever, or are only yet able to be combined in solid bodies of a more inorganic sort, are in certain other different proportions already able to be combined in solid bodies of an organic sort, merely vegetable; in certain other proportions, again different from the former ones, able to be combined in solid bodies of a sentient sort; and in certain other

proportions, again different from the former ones, in solid bodies of a thinking sort, still only brute, and in certain other proportions again different from the former ones, finally able to be combined in solid bodies of a thinking sort, even human, unto the last and highest of the human genus. On this globe however, these elements, from their being driven to it in an uneven, ill-proportioned, distinct and disconnected manner, are still only divided between and combined into a number of different individuals even of the highest genus, simultaneous and successive, each distinct and separate from each of the rest.

But on a globe in which, from its more central situation in space, the very same elements are made from all sides to meet and combine in relative proportions more even and balanced, these elements will no longer only in smaller separate portions, simultaneous and successive, be made to meet and combine in more minute and short-lived individuals simultaneous and successive, separate and distinct from each other, but all be made simultaneously or successively to meet, and to combine in portions of a single individual, more highly and perfectly organised.

Of such a higher and more central globe all the component elements simultaneous and successive will contribute to the composition of an undivided, immense, and ever enduring single individual; or, in other words, of such a higher

and more central globe all the component parts simultaneous and successive will only compose together one single undivided, unseparated entity, of which, according as it gives off, in the process of decombination, part of its substance to other lesser surrounding worlds, the continuance will by parts of the substance from these other lesser surrounding worlds contributed, as constantly be renewed, as on this globe its lesser individualities simultaneous and successive are, each, during a less period, by successive decombinations and recombinations separately promoted. Each of these higher and more central globes may individually in its whole be considered as a single individual, composed of the concentration of the elements of millions of prior separate individuals. Consequently, while here, of the many separate individuals the separate external senses show them little, and that little very partially, so that the rest of their knowledge of the past and future is made up only of uncertain and partial inferences and generalisations of the mind, hereafter the very first impressions made on the external sense itself will be generalisations more extended, more certain, more connected and more satisfactory, affording room only for the pleasures of contemplation, and leaving no occasion for the labour of thought.

CHAPTER XXXIV.

Objections to the individualities, in this world separate and distinct, being hereafter in a higher and more perfect world, blended and made to form a single connected whole.

METHINKS I hear against a doctrine so new and yet so simple, so consistent with the course of nature as the one just enounced, a general outcry composed of as many separate voices as there are hitherto separate individuals, all united in one chorus.

Most people seem, from the way in which they understand certain expressions of scripture, to infer that literally at some single definite period not only the lists of life on this globe will be suddenly closed for ever, but that of all human beings from Adam forward, who have successively risen and fallen on this earth, the separate remains, however widely scattered over the globe, will again be reunited in as many individuals, distinct from each other, as they at different successive periods composed before, in order to be at sound of trumpet marshalled, and collectively transported to some other different abode.

The object of this fancied ordination seems to be, that the same bodies that have died and been dissolved, again coming to life, should receive the reward or the punishment of their prior deeds.

But as it is only by the lives of the different individuals that arise on this globe being each separately very short, compared with the general measure of time during which this globe has borne living individuals; as it has only from the first moment it was ripe for the production of any such, been peopled with different species, and has only ever after gone on producing other individuals and species, rising above the former in rank, by the elements of entities of lower species that have been decombined, again being later recombined in individuals of higher species; as it was only by the same elements in turns serving for the combination of different entities, that the materials supplied by this globe have sufficed for the combination of all the different individuals of different sorts that have been enabled successively to cover its surface, it is clear that the number of individuals, distinct and different from each other, which have thus been enabled successively to arise out of whatever quantity of elements this globe contained, could never have sufficed for the combination of so many different individuals, had they all arisen simultaneously. Had there even on this restricted

globe been room in space for the simultaneous arising of these numbers, there would not have been sufficient materials. The same cards which may serve to play a thousand different games in succession, can only serve to play a single game at once. And what in the nature of things at first was impossible, can never afterwards take place. Of all the different separate individualities that have successively arisen, in consequence only of the same elements having successively belonged to different individuals, no general resurrection at one single period can ever arise. The same elements cannot, at the same period of time, belong to different individuals, though they can in succession.

If the thing were attempted on this globe, how much of the elements first embodied in mineral, and vegetable, and inferior animal productions, all alike short of human beings, before they were ultimately again incorporated in human individuals, might again be hereafter claimed for the revival of these lower entities; and thus not leave materials enough for recombination, even in a small portion of the first human beings that arose, before, by constant reproduction, the number of human entities produced, and again decombined, had increased to its present amount.

But supposing the claims of all individuals of genera inferior to that of man set aside, and those of human beings alone attended to; supposing

it had been decreed that the oyster, the crab, the ox and the ass, the beast and the bird, once dead, whatever good or bad luck might have attended them during life, should never live again to receive some compensation for past mishaps; supposing that of the crab roasted alive in his shell, of the goose made over a hot fire to die of a liver complaint, the account of sufferings should ever remain unsettled; supposing that all the elements of life that had successively passed through all those inferior entities before they subsided in man, should all be reserved for the resurging of man alone; and supposing even that in man individually the very same elements should continue embodied without further change during the whole span of his individual existence, how little would even then, of the materials prepared for the combination of man, remain for the simultaneous resurging of all the human entities, of which different portions had only before been enabled to arise, by rising in successive lots, by a part thereof later inheriting the goods and wearing the garments of their predecessors: and how much less a portion would still remain, if, as can be proved to be the case, in each individual, from the first moment of his formation to the last moment of his dissolution, by a constant influx and circulation of new elements, and exit of old ones, the same elements may, even during the

life of their respective owners, have successively belonged to a number of different individuals.

Each human individual would, for the recombination of his own single whole, have singly to claim, at each successive period of his existence, what, at different periods, not only before his birth and subsequent to his decease, but during his very life, has successively belonged perhaps to millions of other human beings, in turn breathing the same air, and absorbing the same elements with himself.

Each would thus singly, if he did not acquire what he had a right to, labour under a prodigious deficiency; or, if what he had a right to only successively, he thus acquired at a single period, labour under as great an exuberance and superfluity, and leave others to labour under a proportionate deficiency and want. Each would thus, by the attempt to collect in one single continued period of time and portion of space, what had before been spread over many portions of time and space different from each other, have at once too much and too little. The more some, at a single period, received of all that successively had belonged to different entities, the more these other different entities would remain deprived of their due. The disproportions already existing on this globe as it at present stands, in the physical possessions of different individuals of the same species, would be still infinitely in-

the former, and without adverting to which we cannot reason, would be subverted, which would arise from the attempt to make that which has only been able to exist at all, by existing in succession, exist simultaneously.

Each individual who on this globe has had an existence of a certain duration—who has not been stifled in his cradle—being in the impossibility of being hereafter at any one single period of time reinstated in all the conditions, physical and mental, some very different from others, which he has experienced in succession during his long life, seems at least, at the future period when he is to be judged on all his past actions, if judged at all, to have the right of being reinstated in the circumstances of the period which shall appear most favourable to himself; in which he shall have least to account for, and most to demand; in which he was burthened with fewest demerits, and had acquired most claims.

How shall this period of time and place be adjusted by himself? or, if he has no right to make a choice in his own case,—if he is to be reinstated in some peculiar period pointed out for him,—how is that period even by his impartial Judge to be settled? Is he to resurge as he was in his earliest infancy, and before he had been able to incur any faults, and also before he had been able to found any claims? is it to be in the vigour of manhood, when most of his virtues

and his vices, his good and his bad deeds, have come to full maturity? or is it to be in his decrepitude, when he may again have repented of many of his past misdemeanors, or have lost the faculties of body and of mind necessary to incur fresh faults and frailties? If a peculiar average period be chosen, those who have not reached that period may complain of partiality in the judgment pronounced on their future lot; and those who, having reached it, have since much improved or much deteriorated, must be judged with equal partiality. The more different conditions an individual has successively experienced, the more will he, in his return to any one of these in particular, have just reasons for complaining of not having been reinstated in another.

Thus far the difficulties only apply to those, if such there be, who have not been born with some peculiar bias, bodily or mental, to whose undue and unbalanced inclination they have ever after remained subject.

But such individuals, perhaps, do not exist on this globe. If not all its productions, at least a great number, and a greater proportion, according as, belonging to higher genera, and peculiarly to the human species, they are each individually composed of substances, organs, and faculties, bodily and mental, more varied, more complex, more standing in each other's way, are, in con-

creased. Some who already had had too much, would still obtain infinitely more; and others, who already had had too little, would still have infinitely less. Were we inclined to make merry on a subject so serious, we might describe the arms and legs, the ears and noses, that might be singly claimed by a number of different individuals.

And besides the additional inconveniences, conflicts, and sufferings of a physical sort, what additional sufferings of a moral description infinitely more dire would not arise out of this new partition of rights and properties, more unequal, more disproportionate than the worst that could have taken place before! How many dispensations which, according to the present ordination of things, through distance of place and time have their asperities smoothed and blended, would then start up side by side in their harshest crudity! Husbands who before had had more than one wife, wives who had had more than one husband,—but in succession, at long intervals of time, and under circumstances which suffered the duties owing to their first partner to remain compatible with those owing to the last;—fathers who had had children, children who had succeeded to their fathers, in such a gradual way, that the different claims and duties of each age and situation—the care and tenderness owing by parents to their offspring, and the respect and

gratitude by offspring due to their parents,—might be conciliated, that each might give and take what was proper to his respective situation, when they all rose again side by side upon the same level, and with equal pretensions: similar in age, in size, in strength, in demands, and in expectations: how many disappointments, privations, sacrifices and sufferings would they not then experience, not even conceived in the present successive and graduated state of developement of each individual, in which some are from the natural effects of time ready and willing to give up certain claims, at the period when others are prepared to enforce them. How many new and unheard of clashings and conflicts would not thence ensue! unless, indeed, by each individual losing all recollection of times past, by having all thread with a prior existence entirely broken, all consciousness of that identity with an anterior being, for the preservation of which so many difficulties had been encountered and overcome, were entirely obliterated; and it no longer signified whether each was the continuation of a peculiar former individual, or a new individual wholly different.

It would be impossible to set of to foresee any limits to the difficulties, the drawbacks, the evils which would arise out of an ordination, by which all the rules of physics, and thus also all those of metaphysics, in their turn again founded on

sequence of remote hereditary causes, from their very birth condemned to arise, and ever after to live, individually curtailed of a portion of the substances, or forms, or faculties that should generically have belonged to them, and have checked those which they have received.

Their bodily constitution is not in all its parts perfectly balanced, and exerts some evil influence over the constitution of their mind; leaves them all their lifetime more prone to some peculiar passion or weakness, than is consistent with a perfect equipoise of impulses, actions, and behaviour; renders them the unwilling slaves to the sway of some preponderating force, with which they cannot contend, which they cannot master. Are these individuals hereafter to be all reinstated in what they had of excessive, of inadequate, of evil, mixed with the good which was combined in their frame of body and of mind, and which of that good checked and prevented the full extension and developement? are they without any fault of their own, hereafter as well as here, to remain incomplete and defective? are they to supply themselves with what they wanted before, only by robbing of their own those other individuals more bountifully gifted than themselves? or is there to be in store a certain quantity of thus far still unappropriated elements, out of which each individual may help himself to what he wants, in order to

make up his personal deficiencies; and thus, while some only are able to display dearly purchased merits, are others to be assisted in gaining bounties, by wearing feathers not their own?

I see no possibility of the modifications which in the present ordination have only been dealt out to individuals in slow succession, being in a second existence dealt out to certain of them at once and simultaneously, except by still increasing infinitely the disproportion which must exist between the lot of these individuals and that of others: and miserable as is at present the situation of many, if all the deficiencies, all the exuberances, all the imperfections, all the evils, all the confusion, and all the drawbacks which have befallen us successively, were to come upon us hereafter simultaneously, and in immediate presence and contact with each other, man, instead of experiencing a nearer approximation to heaven, would only in every respect launch deeper into hell.

Fortunately analogy, not of that narrow description—for in analogy, as in every thing else, there are degrees—which is only founded on a short period of time, on a restricted measure of space, and on a confined range of modifications, but of that enlarged sort, which takes in long periods of time, vast ranges of space, and vast variety of objects, gives us room to conjecture that the elements emitted by this globe, when

in another more extensive roomy and central world they are again made to meet, and to recombine, will not be recombined in the short and multifarious separate individualities to which they have been restricted by the narrow limits of this globe.

Every thing we see, and reflect upon, informs us, that already, even on this globe, as time advances, and space extends, from points in time and place more distant, elements more varied are made to meet, and to combine in individuals of genera singly in their bodily and mental forms and faculties higher, and concentrating in them more of the forms and faculties, which in earlier genera had only been divided between a greater number of separate and distinct individuals and genera; and we therefore may *a fortiori* expect, that in a future world, wider than this, and in which from more distant quarters more different elements must concentrate, this gradual concentration of genera, and of individuals of each genus, will still infinitely increase: that when of the confined genera and individuals, simultaneous and successive, distinct and separate from each other in time and in space, which on this globe, in small measures of space, and during short measures of time, separately appear and again disappear, the elements, when in a world more roomy, and which can afford them more time and more space, they are

on all sides from a greater distance, with less interference and impediment, again recombined, all the distinct individualities which here, by having what belongs to each genus still intermixed with what belongs, not to that same genus, but to some other different genus, still remain, will entirely cease to exist: that there each individual, singly composed of all the elements of each genus, unimpeded and undiminished by those belonging to any other genera, will have all its forms and faculties united in a higher and less modified degree; that there no room or materials will any longer be left for the combination into individuals and genera of lower descriptions; and that of the higher entities, of man, the genus or individual, placed in a higher sphere, in a more central situation, and endowed with higher faculties, of what is here too distant in time and space, to be otherwise than indirectly and confusedly, and amid a thousand gaps, ignorances, obscurities and errors, presented to the sense, or even to be at most here only still more dimly and uncertainly suspected by the inferences and abstractions of the mind, the very external sense itself will hereafter have already a long and wide, immediate, and clear perception: that then, like a nut, which by degrees developes and expands, the human brain itself will, by the further developement of its organs, no longer remain the instrument of

mere inferences and surmises, but, through dint of the real uninterrupted connexion of all internal objects and modifications, then first seen and first recognised, first become the organ of direct perceptions of external objects even the most remote in time and in place; and will then, in the delightful contemplation of the most distant changes and movements of the universe, expand its further existence. And in the probability of this sort of future state, by analogy to the condition of things past promised, we are by the very words of scripture borne out.

To my apprehension scripture states, that those who here die shall hereafter resurge both in body and in mind; that is to say, shall hereafter receive, as they had here possessed, a material form, to be the medium of their impressions of sense and of mind; and, in fact, we cannot any more hereafter than we can here fancy any consciousness of existence to continue, which shall not rest on certain impressions, received from those modifications of matter of which we are formed. There may exist in nature modifications wholly different from any of those we are acquainted with; but those we do not know, we cannot reason upon.

But at the same time that scripture promises us bodies, it assures us, that in a future existence those bodies shall be glorified. We may thence infer that, more perfect than our pre-

sent bodies in all their organs of sense and of intellect, they will, of the past and present which act upon us, and through the medium of which we are made, by their connexion with the future, to foresee that future, necessarily arising out of the past, also of that future receive a knowledge more ample, and distinct, and connected, and clear, and minute, and void of partial ignorance, error, opacity and gaps, than we do at present: that those bodies shall no longer in their retrospect and in their foresight —in their knowledge of time, of place, and of all else that in these attributes is contained,—be restrained, impeded, stopped by the partial obscurities, opacities, ignorances, and illusions which here below suffer impressions of sense and of mind only to reach us from short, and limited, and partial distances; that the impressions, the means of knowledge that may, from each individual in particular have been made to proceed, shall no longer be checked, be impeded, be interfered with, or be obstructed, by the impressions departing from another different individual; that all entities shall alike of all else around them receive an impression, a knowledge.

How can this take place?—how can each entity singly be endowed with the sight—the susceptibility—of the impressions of objects, movements and changes more extended, more distant, more minute, and more distinct, necessary for

this purpose, except by the separate individualities which here, at every step, check and impede the impressions sent forward, and fill them with dimness and confusion, and prevent them from reaching us, altogether ceasing? except by each entity seeing, knowing, what each other different entity does, and sees, and knows? by each entity still being, with every other different entity, part of the same collective individual?

This exemption from the imperfections, in the present world arising from the great number of individualities simultaneous and successive, each singly partial and limited in time and space, and each necessarily more or less interfering with the wants and desires of the others, which must, in a higher world, be the consequence of their elements being all blended in one single great individual, of which necessarily all the various component parts must harmonize and tend to the same end—this union of all the various interests, views, desires, actions, &c. of each part in one single common whole, already implied in the expression of a body glorified—is still alluded to more directly where it is said, that in a future state there will be no marriage, no giving in marriage: since that single sentence implies the absence, the suppression not only of all prior separation, and all subsequent forced reunion of sexes, but of all the other differences, and disparities, and relationships of hus-

band and wife, of parent and offspring, of old and young, and all others, which on this globe cause such conflicts, and, even when people love each other most, such painful sacrifices of personal interests and wishes, to those of the object beloved. The sympathy which we already feel with certain of our fellow-creatures, and which makes us regard their interests, their concerns, their joys and their sorrows as our own, is only a foretaste of the common feelings we shall then have to a much greater extent, but with this difference—that whereas here we often only find our pains increased by those of others, we shall thereafter only find our happiness enhanced by that of all around.

After all difference of rank and of situation has been levelled by the grave, the earlier disparity which formerly existed in this respect can no longer be supposed to have any weight, and to produce any reluctance to the blending of the elements of different individuals: but at first sight the later difference of character, of disposition, might, to our present imagination, even then offer in the mixing a something repugnant. What! mix up together the elements of a Nero and a Socrates, of a Lucretia and a Messalina! On a more minute estimate of the circumstances, even this objection vanishes. In the present state of things we may often incorporate in our person the elements that have been previously

embodied in the dregs of humanity, in the brute, the vegetable, the inorganic entity. Does this thought, for a single moment, disturb our rest? and will it do so after in ourselves the greater distance of life and death has intervened? will it do so after the elements of those that here below have erred are recombined in such a mode as not only to purify them of all former taint, but to make them abhor their former weaknesses?

All that I have here said and surmised is founded on the supposition that the fundamental attributes of the creation, time and space, are to continue. Undoubtedly we must believe that he who could create, can also again annihilate these attributes, and stop their course and current. But of what might still be left between the Creator and us, if these first barriers that separate the two were removed, we know not; we cannot discourse. All our arguments are founded on the existence of time and space.

CHAPTER XXXV.

Further arguments against the opinion of individualities being hereafter blended.

The doctrine held forth in the last chapter may be objected to, because, by its making the component elements of all the different individuals, first on this globe separately combined, and next again decombined, in another place be re-combined in proportions more even and more balanced, it makes the individuals, out of these elements re-combined, all end by being wise, and good, and happy; and leaves no room or occasion for punishment and correction.

Let us see in how far this objection seems founded. When first man in a state of nature sees a thing which he covets, no matter where found, he tries to convert it to his use. His first wish is that of self-indulgence: of gratifying the feelings of the only person he is well acquainted with. Consulting the desires of another person more distant, and of whom he knows less, in whose feelings he can less enter; sacrificing to these the feelings that are his own, that he personally experiences, is a thing of which

he has no idea, which does not occur to him. He has no thought of committing an injustice, of deserving a punishment, by acting as he does.

Again, when in his turn attacked by a ravenous brute, though he defends himself, though he tries to kill that brute, in order to protect himself from his fangs, he seeks only to put that brute out of the way, not to punish him: he knows that brute, like himself, only seeks self-gratification—seeks not to injure another.

When another man covets any thing the first man possesses, and seeks to take it from him, he equally defends himself—equally tries to prevent that other man from doing him any harm. But when he has not at first succeeded, when he has received some injury, he at least, as soon as he attains the power, seeks to prevent the repetition of the offence, in the author, or seeks to deter others from following his example, by inflicting on him for the injury done a penalty, a punishment.

Hence the first idea of revenge and of punishment. It is only out of the right of self-defence which every man arrogates to himself; it is only out of his weakness, which prevents his exerting that right in full before any mischief has been done him, that he derives the right of punishing afterwards for the mischief done. It is a right resulting from his temporary weakness.

Not trusting altogether to his own power of

punishing, he inlists his God in his cause, threatens his adversary, not only with his own punishments here, but, if these do not suffice to deter that other from doing evil, with those of his God hereafter.

These are the ideas which in man have first produced that of human justice; and have next, in order to strengthen its power, added to it that of divine justice.

But when man, by the extension of his intellect, has come to understand that his God is an entity wholly unassailable to his shafts; an entity exerting over him an unmodified sway; the Author, not only of all his actions, but of all his wishes and thoughts, since these thoughts first proceed from sensations of external modifications produced prior to man; that the Author of man's every wish and thought has, for purposes best known to himself, for a time permitted, or rather compelled man—for in the Author of all that happens permitting is forcing—to harbour evil intentions even toward himself; that God thus must be equally pleased with man's vain attempts against him as with those in his favour; sure that they can do him no harm; that they can only go on while he pleases; that, having first made them arise, he can again put them down at his will, and when they have done answering his purpose, man can no longer in that Almighty Being suppose, for punishing him, any of the

motives which he himself may, in his weakness, have for punishing another man.

Mark that I only here inquire how ideas of justice, of human retribution, come by man to be applied to God: how man, while he thought not his God almighty, and in all respects different from his creatures, might attribute to God motives for punishing him, like those he himself has for punishing other men. I only here wish to prevent the motives, which can only arise from the weakness of the creature, from being by man's short-sightedness attributed to the Almighty Creator. God forbid that I should seem to judge his actions or motives! he may have reasons for making a certain portion of his creatures for a time be miserable, even hereafter, as he has made them be so here; but I only maintain that he cannot do so for reasons as yet known to, as yet conceivable by us, as yet comprehensible to our weak, shallow, short-sighted judgment.

I know very well that man, who is apt to complain of want of freedom of action, when he is made involuntarily to perform that which causes him immediate pain—because there is a direct opposition and conflict, a direct friction and resistance, between the impulse and current of his will, and that of the actions he performs in opposition to it—is not apt to complain of similar want of freedom of action, when he is made to perform an action which is the result

of his own will, even where that action shall more distantly be to him a source of pain. I know very well that man often believes his actions to be free, whatever be their result, as long as they arise out of his own prior will, especially when that will itself is only finally made up, in consequence of his having, between different schemes presented to his imagination, chosen the one he thinks the best; when that will is only the consequence of what he calls his option;—I know very well that the immediate pleasure he feels in doing what his inclination leads him to do, prevents, on the one hand, his foreseeing the pain he may at a later period derive from the measure desired not proving beneficial, and prevents, on the other hand, his reflecting on the thoughts and sensations occurring prior to any will of his being made up, in which the will to do the peculiar thing done first originated; because he confounds the option between doing the one or the other of a certain limited number of things, which may present themselves to his circumscribed imagination, with the condition of being free in his thoughts themselves, of having the power to think and to desire whatever is best; because he mistakes the power of doing the single thing he wills, for the power of willing any thing that may be good; because he feels glad at first to do any thing which affords a gratifying flow and current from his mind within to his

organs of action without; which does not occasion a painful conflict and friction between the one and the other; because he thinks where he does a thing with pleasure he does it with freedom. But his freedom is only that of the man who, irresistibly impelled to slide down a precipice, meets nothing in his way to break his fall. Shall we say that he who only has his choice between a dagger and a cup of poison is free to live?

Even in acting only in consequence of the longest option, the most continued suspense, the most mature deliberation, man still only has the power of voluntarily doing, among a certain number of different opposite things first presented to his imagination, a single one. He can still at last only choose one among a certain number of things which he must previously have had the power of conceiving; and we know how much even in those who are supposed, with the greatest latitude of action, to have the greatest latitude of thought, and the amplest means to make a judicious choice, their ignorance, their errors, their prejudices, their feelings, arising independent of and being uncontrollable by their will, shackle their choice, and set barriers to their power of volition. We cannot say that he who after the longest suspense, the most mature deliberation, still continues irresolute and unable to make up his will, wrings his hands, and cries out, what

shall I do? what resolve upon? what will? is free in his will, in his volition.

Even the option which proceeds most from the knowledge of different contending circumstances, and of the advantages which must result from weighing those circumstances, from mature deliberation, from the volition, the desire to take that option, can themselves only gradually proceed in a circle from thoughts and sensations experienced prior to our will, which first cause that will, which only arise out of external impulses, over which we have no control, and which cannot leave us free to will what we choose, even when we do what we desire. Every will, every thought productive of a will, must have prior to it, and as its parent, a sensation, of which the first, those productive of all the later, are involuntary, and arise from causes outside us and independent of us; and how can we be said to have a free will, when our will depends on thoughts, on sensations, all in their turn depending on impressions which, in the first instance, depend not on ourselves?

Infants have sensations before they have thoughts, thoughts before they have wills, wills destitute of deliberation, of option, before they have wills only formed on mature deliberation. The latter species of wills in many entities arise not at all. In many they arise only very feebly. But in whatever degree may arise the later and

better wills, formed in consequence of more deliberate reflection and choice, which may correct the senseless impulses of a prior and more precipitate will, they still originally, like the first unreflected will itself, arise out of thoughts and sensations, of which the first were experienced independent of any will of our own.

The will which makes us suspend our first impulse to act, till among several modes of acting which present themselves to our mind, we have chosen the one that to us appears best,—the knowledge that such a previous suspense ultimately leads to actions more fitted for our welfare,—are only the later effects and produce of many prior sensations, first resulting from actions resolved upon and executed without any prior suspense, deliberation, option. All men begin, as I have said, in infancy, by willing, in consequence of the impulse of sensations and thoughts destitute of deliberation, of option: and only by degrees, through the sensations and thoughts they are thus made to receive without deliberation, are made by degrees in a less or greater measure to seek the advantages of deliberation.

There is not more liberty in the voluntary actions—in the will of the man who has longest thought, longest reflected, longest remained in suspense before he acts—than there is in the man who, like the brute, most immediately acts in consequence of his first impulse and feeling:

the act of the latter, like that of the former, is an act of implicit submission to impulses given him without his prior leave.

The difference only consists in this, that the brute, and the man in whom reason is not yet matured, are by the first sensation and desire immediately impelled to action, and that the man of mature reason feels a hundred different contradictory springs from one side impel him to action, and from the other side prevent him from acting, before at last one of these springs, more powerful than the rest, predominates, and gives the final impulse; but these different impulses, of which the strongest at last predominates, leave him ultimately as little at liberty in his actions as the brute. The man who, with a knife held to his throat, deliberates whether he shall be murdered or commit a crime, cannot be called free.

Even he who, with wants, appetites or cravings so strong that to resist them makes him suffer immediate and excessive torments, has only, to counterbalance these present sufferings, the weak, dim and vague prospect of the evils less certain and more distant, which may in a future world result from their indulgence, is free just as little. His foresight of the future evils that may check the indulgence of his present appetite, has less power to restrain him than the vision of the present happiness that must accompany its gratification has power to goad him on.

As to the man who could wish out of mere wantonness to offend his God, his Maker, without thinking he thereby did himself any good, he can only be a man out of his senses, irresponsible for his thoughts and actions. But whatever evil a man in his senses may wish to do another man, can only be from the idea of deriving therefrom some self-gratification; of reaping from this evil some personal benefit. He only acts from that motive which God himself has first instilled in all men, that of seeking their own good. If he does not yet know that the means of attaining this end most extensively and most lastingly consist in promoting the welfare of others, this ignorance is the effect of his circumstances, his situation, his involuntary sensations, for which he cannot be held responsible to his Maker, however much he may, for his own security himself, guard against the effect of similar errors in other men. Even if he has sought the truth, and has not yet found it, the fault is not his.

After thus having stated that the reasons, given by man for rendering on this imperfect globe the use of punishments between himself and other weak imperfect men, legitimate, cannot apply to God in a more perfect world, I shall waste no time in setting forth, that even if such punishments hereafter at the hands of God could be admitted, the infant who had been prevented from falling, only by the favour of the destiny

that cut him off too soon, and the elder who on the contrary had fallen only from being left to live too long, would equally be found, according to human views and ideas, to complain of the partiality of Providence: that there would be infinite difficulty to settle, according to human ideas of justice and injustice, by one act, and in consequence of a single line at one instant drawn for ever, the claims to reward and the degrees of punishment deserved for infinitely varied shades of successive good and bad actions; that there would be a great risk of making sympathy with a man's sufferings in hell imbitter all the happiness of his more virtuous friends and relations lodged in heaven, and the more as from greater knowledge we entered more extensively into the feelings of all else around us, and that, as, according to our present knowledge, pain like pleasure can only be continued in time, punishments fixed beforehand to be eternal cannot be conceived; since it always remains in the power of the Almighty to recall them.

Indeed, if we were permitted to pursue human reasonings on subjects beyond the scope of human intellect, and to apply such to God, perhaps we might think that God, having been able to render us at once perfect, good and happy, and having begun by making us imperfect, and consequently unhappy, has dealt hardly by us; but even in this respect we shall probably hereafter,

when perhaps, knowing more, we shall find our very temporary sufferings a source of joy more intense and more lasting, rectify our present erroneous reasonings; meantime resting assured, that even in this world, the more we know, the more we acquire the means of good and happiness.

It may perhaps be asked, why, if a man's will be not free, argue with him? why hopelessly seek to produce in him an inclination to what is good? I say, precisely because his will is not free; because it is swayed by his conviction of the soundness of the arguments he hears; because it necessarily bends to what is held out to it as most attractive; because the chance of making it incline to good is thence full of hope; because, if by sensations and thoughts, first conceived independent of my will, I have first myself been convinced, whether I chose or not, that the road to good is the way to happiness, I must in my turn, as soon as I have acquired the power of making others understand my reasons, also have acquired the faculty of making those others irresistibly conceive a similar expectation of the effects of good, and a similar wish for its propagation; because the impulses I have received, though I cannot help, I may in my turn transmit to others; and thereby influence their minds, as others have before influenced mine.

Perhaps, it may be observed, that I take the wrong method of effecting my purpose, at least in this world, by my arguments for removing the dread of man being, for the evil deeds done here, punished in a world to come.

But as long as people, naturally inclined to evil, fear not to incur, for the sins committed, the more proximate and certain punishments inflicted even here by man himself, they are seldom deterred from crime by the idea of the punishments, more vague, more uncertain, more remote, threatened, in the name of God, in a world to come. People, by their disposition too much alive to the temptation of evil here, or too callous yet to the idea of the penalties thereby incurred hereafter, seldom in the fear of the latter find a counterpoise to the allurements of the former. Inquire of the greatest criminal, and we will in general find that, the moment the apprehension of temporal punishment is removed, the fear of eternal punishment sits light upon him: he hopes he still shall have time to buy these distant threats off.

On the contrary, as soon as people no longer have a preponderating inclination to evil; as soon as already, by the rewards that attend virtue even in this world—the esteem, the confidence, the good-will of their fellow-creatures—they are inclined, even on this globe, to prefer good to evil, the fear of punishment awaiting them here-

after for every trivial fault or error here committed, even unintentionally, by constantly haunting their mind, is only apt to give them a timorous conscience, and to make them hesitate in doing the good in their power, for fear of unintentionally doing the evil they strive to avoid. We see many men who, unfortunately for themselves atheists in their creed, still from mere love of order, of peace, and of the wise rules established by society, are in their conduct most honest and most irreproachable; and we see many others who, sincere Christians at bottom, are nevertheless in their deeds and conduct paltry and pusillanimous subjects.

But whether in publishing this work I was right or have erred, it is only my judgment which has erred. I have neither been deficient in will to do good, nor have I spared the pains necessary to know how to do it. So far from myself founding on any part of my doctrine a licence to relax my principles, I have felt that the further I pursued my theme, the straiter became the shackles which bound my conscience. I may say that in the progress of my work I have eradicated many a vindictive feeling, fostered many a good impulse. If I have not with others all the success I have had with myself, it must have been for want of knowledge, of abilities, not of good intention.

CHAPTER XXXVI.

Characteristics natural and acquired of some of the higher human races.

The principal task which I had proposed to myself at the commencement of this work is now achieved. I have conducted man in general, from his origin, birth, development and death here below, as I hope, to his revival hereafter, in a happier world. In doing so, I have not dwelt upon the distinctive peculiarities of the different human races, pre-eminent in different ages and countries. As, however, in the course of my investigation I have been led to collect a few of the characteristic features that mark certain of the higher nations of the ancient and the modern world, I may, I think, give some additional interest to my work by subjoining these here.

Time, however, begins to run short: my hour-glass empties fast. Obliged to hold myself in readiness for my own no longer very distant departure from this irksome scene of bustle and disquiet, I shall not tarry long on the detail of these incidental contemplations. I shall, even

to some nations sufficiently remarkable in the annals of the world, only devote a few lines, and shall become somewhat less concise only as I approach nearer to some of the more mixed races, which on all sides surround us more closely.

On the faculties physical and intellectual of the Malays, who inhabit the south-eastern shores and islands of Asia, nay, on the Monguls, who rove over its higher and more central table lands, I shall not expatiate; I shall only bestow a few words on those more extreme ramifications of the latter stock eastward, named Chinese and Japanese. I shall act in the same way further westward respecting the Hindoos and the Egyptians of old: those eternal themes of endless writers, which it is not easy to handle afresh without producing complete satiety.

Laplace mentions the Chinese as possessing the most ancient observations of which any use can be made in astronomy. He states the eclipses recorded by them as proving that science to have been cultivated in China more than two thousand years before the Christian era. I am not sufficiently versed in the knowledge of the heavens to investigate what pretended observations of an earlier date the Chinese may only later have arrived at, merely by the easy process of calculating from real phenomena, watched at a later period, their way backward. I can only say, that having gained credit so early for so much know-

ledge, the little comparative progress they have since made in science is truly astonishing. They seem in reality only to have exchanged the original rudeness of man for a mere external polish, not the result of spontaneous developements produced by an energy of force from within, but only effected by the mere external contact and friction with other nations, fraught with greater natural powers—perhaps with the Japanese, who seem a ramification of the same race, by nature itself more highly endowed.

With whatever other nation, more exalted than themselves, an early connexion may have given the natives of China their external gloss, it only serves more strongly to mark their internal hollowness. They labour under that radical vis inertiæ which, at whatever height the impelling force is withdrawn, leaves modifications in a lifeless state, equally incapable of further advancement, and safe from rapid retrogradation. Their decline has been as slow, as gradual as their progress. When by the failure of their instructors left abandoned to their own resources, they remained at a complete stand-still, and only exhibited the phenomenon of a nation, early taught beyond its years, which never comes to maturity, and long tires the world by its lasting imbecility. They sport a set of social forms, of inventions of art and science, each singly very refined, but each unconnected with the rest: neither retain

any remembrance of the steps by which they had attained so early an eminence, nor show any symptoms of further progress. All their acquirements betray those gaps and discrepancies which must ever remain perceptible, where civilization is not the result of natural vigour of intellect, but only that of successive importations from foreign climes. The Chinese, destitute of those connecting links between the different arts and sciences, observable where they all arise from a single indigenous stock, have not even been able, in spite of some very ingenious traditionary rubrics which from time immemorial they retain, afterwards to blend together their desultory and detached traditions by some subsequent artificial cement into a connected body of knowledge. Totally helpless, totally incapable of using their own science to advantage, they seem a nation, not from a state of gradual elevation again as gradually declining, but a nation who, suddenly raised to a certain height, are there struck with, and fixed by, an irremediable palsy. Elate with all the pride of the steps they once achieved in civilization, all strength to make a single further stride has forsaken them.

A part of the sudden torpor which appears to have overspread their intellect may perhaps have been owing to the imperfections of their idiom. In the Chinese language the audible

signs of ideas that speak to the ear have not themselves in their turn, as in other languages, by a gradual extension of the same process, produced the visible signs that speak to the eye. These latter are not a second-hand representation of the former. Written words in Chinese have no immediate relation to spoken words; and often the latter are very different in provinces in which the former are the same. Remaining in great measure symbolical, their written characters to this day continue so numerous and so intricate, that the time employed in acquiring the mere vehicles requisite for conveying the few ideas they possess, leaves no leisure for extending and combining the ideas themselves: that words, instead of facilitating the circulation of thoughts, seem often among the Chinese only to embarrass their current, to arrest their flow. But the very defects in their means of expression argue a deficiency in the scope of the mind, which could leave them so permanently unremedied.

The effect has been, that the Chinese, perhaps in early periods of the globe looked upon as precocious children, perfect before their time, have for the last twenty centuries remained little better than effete and imbecile dotards, still sporting their leading-strings; still poring over their spelling-books; still cherishing a government so truly paternal, and so suiting its corrections to the capacities of its subjects, as to inflict on the highest mandarin, when im-

perfect in his letters, the punishment of children. When well behaved they are permitted to sport a peacock's feather; but when in disgrace, a crowquill announces their degradation.

The feature most remarkable in the Celestial Empire is the age it has attained without a national worship: for such it cannot be said to possess. The prevailing doctrine, that of Fohi, is only followed by insulated sects, and the members of the government have not an established common creed; a circumstance, in an empire so immense and so compact, from which might be drawn inferences useful in the regulation of other states. No doubt China owes much of its stability to its mass, and to the weakness of surrounding powers. Yet it has been overwhelmed by its Mongul neighbours; but strange to say, the conquerors have assimilated with the conquered, instead of changing their institutions.

The sole universal worship in China is that of Etiquette. A minute and punctilious observance of the rules of the most absurd ceremonial stands in lieu of religion, of science and of virtue. Every form is surrounded by its fetters, every movement impeded by its trammels. The circulation of the saps is not more checked by iron wires in the vessels of their dwarf trees, or that of the blood in the feet of their females, than is, by unremitting attention to received formalities, that of ideas in the minds of their gravest characters.

From the Chinese pass we over to the Egyptians, a nation as early, but of shorter duration, with whom they have frequently been compared.

In any country the spontaneous produce of the soil, starting up at every crevice, breaking forth from every spot, can scarcely be repressed, be concealed. It will make its way into daylight, and will with difficulty be rendered the monopoly only of a greedy few, envying the rest of the population its riches. Different is the case with exotics, imported as a rarity, where these exclusive attainments can enable their possessors to rule the remainder of the nation. This the priesthood did in Egypt. The sounder doctrine they had borrowed from the east remained carefully concealed in the recesses of their temples, while the people at large were abandoned to the grossest superstition. Lest each man should adopt the calling for which nature and his situation fitted him best, the nation was divided into castes, and each profession hemmed in by a barrier, shutting out all chance of emulation and improvement from within. The horror of the sea and the seclusion of the deserts that surrounded the land of Egypt equally proved a bar to all improvement from without: and while other nations advanced, Egypt only experienced a corresponding decline. In its indestructible monuments and in its in-

corruptible mummies, ancient Egypt seems to have had in view to typify the vis inertiæ which was attempted to render every thing stationary, and destitute either of advancement or of retrogradation.

The Hindoos, kneaded of a somewhat finer clay, cast in a somewhat superior mould, than either the Chinese or the Egyptians, prodigiously slender in their forms and supple in their articulations, have, according to Dr. Paterson of Calcutta, skulls by one-third less in capacity than those of most European nations. They seem very callous in their feelings both of body and of mind. Not only they behold unmoved the sufferings of their wives, parents and offspring, but from superstitious motives inflict on their own persons tortures of which Europeans could not endure the long agony. Their vulgar creed every where is a farrago of the most revolting absurdities: among these, we however trace the doctrine of a Trinity, which has some features of similarity with our own.

So vast a tract of country, however, contains tribes immensely distant and varied in their organization both physical and mental: in their manners, morals, characters, and dispositions.

The Nutts or Basigars, in their idleness, aversion to all regulated industry, and indifference to religion, resemble and probably in some of their ramifications gave rise to that refuse of society,

which afterwards in shoals, athwart the Straits of Constantinople on the eastern, and those of Gibraltar on the western side, entered Europe; and under the name of Egyptians or Gipsies,—that of the last country different from their original home, in which they seem to have made a long residence,—to this day still astonish England with the display of their eastern forms and complexions, habits and manners.

The Rajpoots, as unbending as the former are flexible, distinguish themselves by the energy of their character and the firmness and hardihood of their disposition: and the Sikhs, who every day with their conquests extend their creed, equally scouting the polytheism of the vulgar, and the Trinity of the Brahmins, disseminate over a great part of India a pure and unmixed theism.

In or near India seems to have been the earliest focus of much of the civilization, and of many of the arts, that have since spread more eastward and westward. Many words of European languages seem derived from the Sanscrit. To India we moreover owe our numerical characters; and in India many arts and sciences, since revived in Europe, have been practised in very early periods. Did the Indians first invent these? or rather, as is most probable, were the northern provinces of Persia, after the deluge which overwhelmed the incipient rudiments of human civilization, the first cradle

where they afresh dawned? Did after that deluge, beginning with the waters pent up in the table lands of Tartary, which broke through their barriers, overwhelmed Asia and Europe, and only subsided in the vast ocean, in the regions in which Noah's ark first saw land, and struck the ground, the first return to civilization and the arts of life take place?

Of Arabia the most central tribes never perhaps extended their rovings beyond the limits of their native deserts. To this day, their race remains in their impenetrable fastnesses pure and unadulterated. Only at their outskirts did their overflowings mix with and spread over surrounding regions. They generally exhibit features small, shrivelled and depressed, forms meagre and stunted, complexions adust, hair coarse and scant. Regarding their right of property to whatever surrounds them as intact until expressly renounced, they live a predatory life among themselves, and stand in respect to strangers in the light of robbers and of thieves, till these have thrown themselves on their mercy, and made it worth their while to use them gently. When once the compact is closed, it is religiously adhered to, and their hospitality only finds bounds in their means.

To their wives, children, comrades, domestic animals, and whatever is their own, they are strongly attached. They live under the lax

control of hereditary scheicks or chiefs. Their worship originally was that of the heavenly bodies, called from the Arab word sabiyé, or host, sabeism. They seem to have been given credit for intellectual powers beyond their deserts. When their later descendants filled the thrones of Bagdad and Cairo, and founded the schools of Damascus and Grenada, it was under the tuition of the Greeks of Constantinople. These people of a higher race remained to the last their teachers in mathematics, in medicine, in astronomy, in philosophy, and in whatever abstract sciences the Arabs had the credit of cultivating; in truth they only watched the movements of the heavenly bodies for purposes of astrology, and they only investigated the properties of earthly substances for those of alchemy. In the fine arts they never attained any eminence.

From the physical resemblance between the Afghans and the Jews, Sir William Jones suspected the former to have been an offset of the latter. The converse of this position seems to have been nearer the truth. The Chaldeans, and thus Abraham and the Jews, seem to trace their source from the neighbourhood of the Afghans. Abraham carried from Mesopotamia into Canaan the pastoral habits of his ancestors, together with the creed, common to the Indians, the Persians, and the Chaldeans.

The nations bordering on Arabia seem to have

highly venerated, under the name of Bethyles, those aerolythes which they supposed to have dropped from the sun; and of which the most celebrated was, many centuries later, by its high priest Heliogabalus, transferred from Emesus to Rome. One of these stones is to this day inserted in the walls of the Kaaba, or sacred chapel of Mohammed at Mecca.

As to Abraham, his only stationary abode in the land of Canaan seems to have been the sepulchre dug in the rock, which he purchased for Sarah his wife. His numerous descendants appear, during their two hundred years' stay in Egypt, to have on their original belief grafted many of the kindred tenets of the Egyptian priesthood. Among the latter learned class, the leader, lawgiver, and historian of the people of Israel, Moses, was born and bred. The traces of the doctrine and practices of Egypt may be recognised in all the Mosaic laws, dietetic and others, of which the maintenance was peculiarly intrusted to Moses' own tribe, that of Levi, on which exclusively devolved the hereditary priesthood of the Jews. Earnestly as Moses contended for the worship only of the true God, his own brother, Aaron, however, still showed propensities to idolatry, when, during the lawgiver's absence on Mount Sinai, the latter set up a golden calf, to be worshipped by the people. Moses was said to have been the only man, even among the Jews, to whom the Deity had appeared face to

face; for to others, to whom God seems to have signified his will more directly, it was still only transmitted in dreams or visions, or through the medium of messengers, or in some other more doubtful and questionable form. The Supreme Being is, however, in the Old Testament, still often described as possessed not only of the features but of the passions of man. The powers of evil are in the Scriptures represented as often still with those of God maintaining a successful conflict. Bloody sacrifices are still deemed required to propitiate the Deity. Men of a lax morality often were said to have found favour in the eyes of God; and rewards in an existence hereafter, or rather the immortality of the soul itself, is in the Old Testament entirely passed over in silence; so that afterwards the Sadducees disbelieved this consoling tenet, and the Pharisees only inferred it from other dogmas more directly belonging to their creed. What wonder, then, that, when the promised Saviour came, and spoke of things more familiar to the ears of Gentiles than Jews, the chosen people of God should have shown themselves the least ready of any to adopt the great fundamental tenet of the Christian belief? They were punished for their incredulity by becoming, as the gipsies have become since, outcasts on the face of the earth.

Of the country anciently called Iran, and comprehending Syria, Assyria, and Media, of which modern Fars, or Persia, is only a province, the

natives had fine forms, still retraced in their monuments, and rich complexions, still retained by their descendants. Their features, different from those prevailing among the Arabs, presented a convex line; their hair and beard were curly, copious, and had that marked outline distinctive of a high race. Their primitive religion seems to have been a pure theism. This led to the worship of the elementary fire, of which the heavenly bodies were the offspring. Thence their veneration for those stones once supposed to have dropped from the sun, and now known to be formed in our own atmosphere.

Most of the nations here described acknowledged, in addition to the principle of good and production, a distinct principle of evil and destruction, called Ahriman by the Persians, Typhon in Egypt, and Satan by the Jews. Their priests were called magi; and from them the name of magicians still is given to those who, through the ministry of the stars, affect to possess supernatural powers. Their temples had no roof but the firmament. The history of their first monarch is considered by eastern nations as the most ancient tradition existing. The Bible itself mentions Nineveh, situated in the plains of Mesopotamia, as the first of cities; Babylon, on the Euphrates, as the second. Their earliest, and afterwards, when falling into disuse, sacred language, was the Pahli, parent of the Sanscrit, which diffused itself in India.

Theirs were the nail-head characters traced on the brick walls of Babylon, and on the basaltic pillars of Persepolis. They entertained the metaphysical idea of the invisible first cause of matter and of mind gradually assuming all the later and more partial forms, which matter and mind manifested to man. God was by them identified with nature. They regarded the universal soul of the world—its capacity of being modified into different sensible shapes—as constituting the Deity itself. Of the visible creation the different attributes, first emanated from God, were, after a number of different successive developments—expressed, or rather obscured, in India by the tradition of the successive incarnations of the divine essence; and among the Egyptians, by the doctrine of the metempsychosis, or transmigration of human souls—all destined ultimately to be again reabsorbed in the bosom of their first author: and this idea was so equally prevalent among the philosophers of all the countries bordering on Persia, that the Greeks went in search of its recondite truths indifferently to Egypt, to India, and to Chaldea.

It was from Persia that during the Babylonish captivity the belief in the immortality of the soul, entertained among most Gentiles, first made its way among the Jews: but it found easier access among those of Samaria than among the

more rigid Jews of Jerusalem; so that when our Saviour appeared, those to whom he was most pointedly sent were the least disposed to receive him.

Indeed, what in the creed of the nations thus far described seems to have been most elevated, most approaching the purity of perfect theism, appears only in it as scraps and remnants of the theogony of some race, higher than those remaining, of which the history seems lost. For among none of the nations to whom this belief was said to belong was it diffused among the people at large, as it would have been, had it arisen spontaneously in their bosom. Among all of them it was the exclusive possession of the higher orders and the priesthood, who jealously concealed its tenets from the knowledge of the vulgar, and rendered it not the means to enlighten, but only the instrument to enslave the nation at large. Only when the movements of the stars ceased by all to be considered as announcing the peculiar designs and disposition of their Creator, did it first become lawful to all to watch their evolutions.

From the Gin and the Peris of Persia are derived our tales of the genii and fairies; as from Antar and the Arabs appear borrowed our chivalresque traditions.

The regions that spread to the south of the Caspian seem to have been the cradle of the

highest nations, of which to this day the descendants flourish on the surface of the globe. There existed the paradise of Scripture; there soared Mount Ararat, on which, after the subsidence of Noah's deluge, the ark first struck ground. There arose the Armenian monarchy, the first of all those which later became the theme of history. Thence descended the Assyrians, the Medes, and the Persians, whose regions beheld the first great cities of the globe, Nineveh and Babylon. Thence first spread eastward the cultivation of India, as the Sanscrit, the eldest daughter of the Pahlavi language, denotes; thence first ramified westward the Pelasgian and the Hellenic nations. Thence extended northwards the Celts, and after them the Teutones, whose tongues, it is now ascertained by the learned men of Germany, only derive their fundamental affinity to the Greek and Sanscrit from their common parent, the Pahlavi of Persia. Indeed, the Druids of the Celtic and Gothic nations still long retained to the Brahmins of India a remarkable resemblance; as did the nobles of those more northern climes to the rajpoots and warriors of the regions through which flows the Indus.

The Scythians, and their descendants, the Sauromates, who, in their progress westward, followed the Celts and Goths, and settled in the eastern regions of Europe, of which the others

had already occupied the western provinces and the centre, seem to have had an origin different from that of either of these latter, and to have subsequently remixed more with other later supervening Asiatic races. The Celts, the foremost of the tribes that from Asia migrated to the west of Europe, appear, under the name of Britons and of Gauls, to have, in Great Britain, France, Spain, and Italy, had their career stopped only by the waves of the Atlantic and of the Mediterranean.

The Teutonic or Scandinavian races which, under the various appellations of Suevi, Vandals, Goths, Angli, Saxons, Danes, and Normans, and sometimes under denominations derived from circumstances more partial, as of Franks, Allemans, Burgundians, or Longobardi, by the more advanced Celts checked in their progress, chiefly settled in the northern and middle regions of Europe, whence some penetrated to its very southern extremities.

The Sauromates were, under the various denominations of Russians, Poles, Bohemians, Valachians, Bulgarians, Albanians, Epirotes, Illyrians, and Sclavonians, the last nations that filled the eastern margins of Europe, from the White to the Black Sea; and finally, the offsets of the Pelasgians and the Helleni, achieved in its most southern extremities the population of our quarter of the globe.

Of these ramifications westward, of stocks different in their eastern origin, the primitive features bodily and mental must, in the different countries to which they successively penetrated, through the gradual effects of difference of climate and situation, and the influence more rapid of constant intermixture of races, have become so altered from their original type, and above all so blended with each other, that it is difficult at this day to estimate how much of these original characteristics still subsists, and what part thereof belongs to each race in particular.

Yet may we in the Teutonic races still distinguish a muscular system more spread and more loosely knit; an ossous texture more ponderous, more diffused, and laxly interwoven; a facial outline, either in its narrow length, or in its shortened width, more deviating from the perfect oval shape; a nose, in its aquiline or concave outline more strongly divided from the forehead, less insensibly prolonged from the brow; jaws more squared, gums less arched, lips less curled, compressed, and wavy, chin less round and full, articulations less fine and flexible, extremities less taper, eyebrows, eyelashes, hair, whiskers, and beard less silky, less luxuriant, and yet less trimly disposed; complexions, in their local tints more insipid, more monotonous, less varied, less contrasted; movements, attitudes, and gestures less easy and less expressive; eyes

less animated, and less full of subdued fire, than the perfection of human beauty seems to demand. Their sensitive organisation still seems to labour under a certain obtuseness, their mind to want a certain flexibility. In early eras the heroes of Edda were represented in the palace of Odin, as in the morning cutting each other in pieces for pastime, in order only in the evening to have their limbs reunited, and to get drunk; and to this day the descendants of these doughty warriors are more remarkable for feats of mere strength than of agility. Their national dances display more activity than grace; more of the angular than of the flowing line; more unmeaning shakes than impassioned gestures. It is not they who excel in fencing, in sleight of hand, in feats of manual dexterity. Even those among them that are most sensible to the charms of music, have not that flexibility of fingers which alone gives pre-eminence on the violin. The lower orders among them care little for the productions of the fine arts, for which only a studious cultivation gives a few individuals of the higher classes a forced taste. In their carriage they display little elegance, in their costume little refinement. In holding forth to the public, they accompany not their oratory by the emphatic tones, the expressive gestures, of their more animated Celtic neighbours. Their minds, less comprehensive and less versatile, simultaneously

embrace fewer ideas, follow up fewer designs; from one train of thought, one species of pursuit, pass over more slowly, and with greater effort, to another pursuit wholly different. They are less fertile in expedients, less varied in resources, less apt to unite opposite talents; they continue longer, with obstinate perseverance, after the chance of success in a design is gone by, to follow up the beaten track, heedless of the new prospects of superior advantage in a different line, that may open to the right and left. Should their efforts, in one career, one line of life, fail to answer, they feel less able, less disposed to turn their hands and minds to another and different sort of employment; and sooner fall into entire and hopeless despondency. They can less adapt themselves to every difference of time, place, circumstance and person; have less of the ingenuity which hides the most important designs under the semblance of mere pastime, and less of the dexterity that gives the most trifling amusements an air of elegance and of dignity. Both their confidence and their distrust easily run into extremes, and are expressed without caution.

Some of them have more of that inert and passive pride, which wraps man up in contemplation of himself, and shuts him out from familiar contact with his fellow creatures, than of that active and bustling vanity that wants the pre-

sence, and seeks the applause of beholders. They strive less to gain the good will of others by those trifling demonstrations, of which the smaller individual value is more than made up by their number and frequency. More tenacious of their own opinion, they are less tender of the prejudices of others; they tread, if I dare so express myself, on the intellectual corns of their vanity more incautiously. Often they fail in great objects, by their overweening solicitude about trifles. More imitative, they owe their arts of utility and of elegance, their very sciences, their forms political and religious, their language oral and written, less to their native genius, more to the example of others. It is true that, less voluble, less distracted by new pursuits, they often carry the performances on which they are intent, to greater perfection; they leave not a great work half finished, attracted by another enterprise which presents greater novelty. Some of their idioms have preserved much of their original purity; others are, like those that use them, become a compound of shreds and patches, collected from the same different quarters from which are derived the more tangible refinements they represent. Among the Gothic races, the lower classes seem not to feel the gradations that intervene between the tone of abject servility, and that of untaught insolence; nor do the

higher orders encourage their dependents to show, athwart the deference due by inferiors to superiors, the respect due by man to himself. There is in the tone of the lower ranks too much abject servility; in that of the higher classes too much unmodified hauteur,—too little of that urbanity, which at least smooths the descent to different levels. In all classes, whatever internal warmth pervades the heart, is slower in relaxing the icy rigour of the external appearance. Even while seeking to impress their hearers with the most vital truths, the action of their orators is frigid. The soldier is addressed with the cane; more dependence seems placed on the rhetoric of that instrument of pain, than on motives of a more ennobling nature.

Let it however be remembered, that I here only form a general estimate of what might be supposed to have been originally the average disposition and character of a race that has since spread over, and for many centuries has peopled, the whole north of Europe, the regions invaded by Sarmatian tribes only excepted; and of that race, as it was in its original rudeness, as yet unmodified either by the slower influence of different climates, latitudes and situations, or unchanged by the more rapid effects of intermixture of races; which latter nevertheless has in reality been so great, that in some countries it would be difficult in its natives to distinguish

what, during the lapse of many centuries, has been retained of the original leaven, and what may have been since contributed by the effect of each later adventitious circumstance in particular.

The difference of climate alone may have, on the one hand, produced effects so different, that while in England a spontaneous feeling for music is a nonentity, a national melody a nondescript, in the Tyrol the very bells of the sheep are tuned to regular octaves; and the difference of cultivation alone may, on the other hand, produce all the difference we observe in all countries alike between the lowest bred mechanic, and the highest bred gentleman.

CHAPTER XXXVII.

Continuation of the former chapter.

THE Celti, Keltoi, or Galli, from the western shores of Asia, where they gave their name to Galatia, seem early to have made inroads in Greece Proper; and thence are by Ginguené supposed to have passed along the banks of the Danube, pushed on to Gaul and Britain, and to have flowed round to Italy and to Spain. They were afterwards again dispossessed of a great part of their conquests, in Britain, by the Angles, the Saxons and the Danes; in Gaul, earlier on the eastern side by the Franks, and later on the western side by the Normans; and in Spain, to the north by the Goths and Vandals, and to the south, by the Moors. Their original name of Keltoi or Galli is still retraced in the appellation of the Scottish dress, called Kilt; in the Gallic idiom of North Britain, and of that part of Ireland which from Scotland received its later population; in the denomination of those opposite provinces of England, distinguished by the appellation of land of the Welsh or Wales—païs de Galles ou des Gaulois—and in the name of Welschen,

still given by the Germans to the Gallic tribes of France, and of the north of Italy.

Most people consider the different idioms of Italy, of France, of Spain and of Portugal, as later corruptions of the Latin language: but the Latin, properly so called, only spoken late in the centre of Latium, in ancient Rome itself, and even there only familiarly used by the higher orders, could not, during the short time it prevailed, have spread its ramifications so far and so durably even among the lower orders of the more distant provinces of Europe, as in these to have entirely extinguished a more early indigenous language wholly different: if such had existed.

I therefore consider Celtic roots, anterior to the Latin, to have laid the foundation of the languages not only eastward of Italy, in Valachia, Moldavia, Bulgaria, Hungary and Poland, by the races not of Sarmatian origin who people those regions, and not only westward of the Italian peninsula, in France, Spain and Portugal, but in the very heart of the peninsula of Italy itself already spoken, before in Latium its peculiar dialect of that language was, by admixture with the neighbouring Greek, refined into the loftier language used by the higher classes of Rome. This language continued long, under the appellation of Langue Romance, to prevail in the south of France; whence, as low down as the reign of Louis XIII. its western

ramification, still, under the name of Langue d'Oc or d'Occident, reached as far north as the Loire, while its eastern branch, named Langue d'Œil, under that of Welsh or Walloon, to this day maintains its ground in the environs of Liege.

In the more central parts of ancient Gaul, the Celtic was later again by the inroads of the Franks remixed with the Teutonic idiom, and became that more degraded and bastardised French language, which, notwithstanding its nasal *n*, its hardly sounded final *e*, and its total want of rhythm and cadence, has long been the favourite language of European courts.

Even that most northern division of the French nation, in which most Frank blood was remixed with that of its earlier Celtic stock, seems already to possess organs susceptible of impressions somewhat more acute and varied than the neighbouring races more purely Teutonic. Their carriage is less unhinged, their gait less slouching. This ossous system shows greater compactness, their muscle closer knitting. In fencing, dancing, and other exercises that require skill and agility, they display more grace and precision. Their cookery, perfumery, attire, utensils and furniture are the offspring of senses more refined. They invent more, and to every object of utility they add more appropriate ornament, for the mere pleasure of the eye. Of every trifling gift of person, situation and cir-

cumstance, they take greater advantage. With smaller means they produce greater effects. In their mirth, the lowest classes are less addicted to vulgar excess, more caught by the eye, fonder of refinement. Their spirits are more elastic and buoyant, their tread is lighter, their address more unconstrained, their punctilio less measured by rule and compass, their mind more active and versatile, their manners more adapted to varying circumstances of time, place and persons. Their soldiers show greater capability of becoming officers, their artisans of rising into artists. Emulation carries them farther. Their conversation turns on a greater variety of topics. Their passions while they last are stronger, but sooner change their object.

In the northern provinces of Spain, the Celtic blood has in the middle ages been so remixed with that of the Goths and Vandals, and in the southern districts with that of the Moors of Africa, that it is difficult to assign the characteristic by each of these opposite races left of the original stock, and those subsequently ingrafted on the same. The richer rays of the sun give at once more vigour and more elasticity to the human frame. The whole of the hottest day in summer, the Castilian muleteer keeps pace with the trot of his mules; and Spain has long supplied the rest of Europe with the most active tumblers and rope dancers.

Among the lowest classes the carriage is lofty, the gait studied, the language musical, the attire gay, sumptuous and picturesque. Their national dance, the fandango, seems the result of an organization more flexible than that which suggested the hornpipe. Dignity of mind and manner mark the Spanish hidalgo: from Spain, the north of Europe first received the laws of modern chivalry and the rules of the modern drama. Later, the Inquisition again palsied the early progress of that country, and made it retrograde in proportion as other neighbouring regions advanced.

The name of Portus Calé, first only given to the most celebrated harbour on the western shore of the Spanish peninsula, by degrees became applied to the whole of Portugal. The mongrel breed of its capital, the produce of its most distant opposite colonies, gives an unfair idea of the more genuine descendants of the Celtic race that people its provinces. These latter still show that lively disposition, that proneness to dance and song, that refined diction, that genuine taste for poetry, that native urbanity and courteousness of manner, which, in the austerer climates of the north, seem only the artificial offspring of a higher cultivation. The Portuguese were the first bold navigators among modern nations. They first made the power of Europe re-extend over the realms of Asia. But

their glory was but of short duration; and Coimbra only just had time to show what Portugal might have become under favourable auspices, when there, as in Spain, learning became dangerous, research prohibited, and the expanding mind of the Portuguese forced to shrink in the bud, and to revert to its primitive nothingness.

Ancient Celtica extended from the mouth of the Po one way to the outlets of the Rhine the other. It included at one time not only what was called Gallia Proper, but what has since, in consequence of fresh eruptions of Teutonic tribes, received the name of Lombardy. Of the Italian peninsula, the earliest inhabitants, not of Grecian origin, seem all to have been of Celtic race. The different dialects spoken to this day, even at Florence and at Rome, far from only seeming, as we generally regard them, later corruptions of the Latin, appear all to have been so many different earlier varieties only of the original Celtic dialect, spoken before it was refined into Latin; since to the last these dialects have continued to bear, not as they would have done, had they only been corruptions of the Latin, the same common name with the latter, but the distinctive appellation of the several distinct peculiar regions in which they arose.

Of Latium the peculiar dialect originally bore

the greatest affinity to the Oscan, itself a ramification of the Celtic. In fact, the names of the Roman deities, not borrowed from those of the Greeks, were purely Celtic; and Dionysius Halicarnassensis expressly says, that the ancient language of Rome was neither wholly Greek, nor wholly barbarian. The oldest specimen of it remaining—a hymn of the Fratres Arvales, referred to the fabulous era of Romulus, and a fragment of the laws of Numa, in Festus,—are nearly allied to the Celtic.

By the higher classes of Rome, themselves composed of heterogeneous elements, from all the surrounding states made in its wide basin to flow together, and to mix, its first rustic language was subsequently refined into the more lofty dialect, never familiarly used by its plebs, which seems to have been, under the name of Latin, confined to its patricians; and of which the still remaining inscriptions show how little the orthography was fixed. Its first improvement appears to have been derived from the Pelasgic Greeks of Etruria, from whom the Romans borrowed their earliest industry, arts, sciences, civil and religious institutions. The later polish seems to have been given it by the Eolian and Doric dialects of Magna Græcia. Thanks to these, it became disencumbered of the auxiliary verb, and enriched with numerous Greek words and *constructions.*

Ennius, the poet, was the first who greatly

improved the Latin language. Plautus added new distinctions between the diction of the patricians and that of the plebeians; but even Cicero still mentions how few in his time were the ladies of that capital who spoke its language correctly. Nay, Quinctilianus himself speaks of the difficulty of learning pure Latin in the midst of Rome. The idiom of the lower class was called the lingua vulgaris, or rustica; that of the higher class alone was distinguished by the name of urbana. Indeed, to the last, the Roman people delighted in farces in which prevailed the Oscan dialect, the first that was spoken on the site of Rome.

The delivery of the Latin seems to have been as studied as its forms were artificial. The cantilena, still preserved in their conversation by the modern Romans, was in the set speeches of the ancients carried to the highest pitch. According to Cicero, Caius Gracchus used to be attended in the rostrum by a flute player, who, before he began his orations, gave him the proper intonation; and we know, from Cicero and others, what importance was in Roman oratory attached to the propriety, the elegance, and the impressiveness of action.

The Latin language of Rome, confined to the higher classes, can never have been considered as the true criterion of the civilization of the plebs of Italy, or even of that of the population of the eternal city itself, taken in general. It was the stilted result, when Rome became the

capital of the known world, of an artificial turgescence. It ceased with the greatness of Rome.

When the seat of the empire became, from the banks of the Tiber, transferred to the shores of the Hellespont; when the Romans no longer felt proud to borrow forms of art from the Greeks, but the Greeks thought to acquire consequence by calling themselves Romans; when their own language, degenerated from its primitive purity, took the name of Romaic; the Latin itself again lost its artificial inflation, relapsed into those laxer and less turgid forms, never wholly abandoned by the bulk of its population, and re-became more akin to the other Italian dialects. The pompous Latin only remained the vehicle of erudition and of science among the learned men of Europe, who were still ashamed of speaking their vernacular tongue.

To the natural vigour and suppleness of body of the Celtic races, which supplied the bulk of the population of Italy, bear witness their dancers, their jugglers, their groteschi, their saltim banchi, their long-acknowledged pre-eminence in the arts of equitation, of fencing, and others of activity and skill. The sensibility of their ear and eye are attested by the eminence they attained in music and in the imitative arts; and their vivid and flexible imagination made them excel equally in the humorous productions and in the higher departments of literature. Nor should their more

brilliant accomplishments blind us to their superiority in the arts of utility and in the researches of science. The soil of Italy first gave birth to banks, exchanges, book-keeping with double entries, paper currency, Lombards, insurances, maritime laws and consulates, the compass, and the other great improvements in navigation and in trade. To Italian industry and genius are owing the most important modern discoveries in astronomy, medicine, mathematics, chemistry, and physiology. In Italy, civilization, after shedding its last dying rays at Constantinople, first was seen to revive with increased splendor.

But it should be remarked that precisely while the numerous small states of Italy were most a prey to internal anarchy and to external warfare, did the friction of contending interests and passions elicit the most brilliant coruscations of its genius. The weight of the despotism that since made the Italians subside into quiescence, also extinguished all their fire; and the degraded Italian of the present day can scarce himself believe that the great monuments which ennoble his country were in part the work of his own more enterprising ancestors of the middle ages.

CHAPTER XXXVIII.

Continuation of the characteristics of peculiar nations.

WHOEVER names the ancient Greeks, names the nation gifted by nature with talents the most rare and diversified which history has handed down to us. We find their race, wherever in its progress westward it reached—in Asia, in Europe, in the islands of the intervening archipelago, at the southern extremity of Italy, in whose soil the Romans founded their later cities on threefold tiers of earlier Grecian tombs, or on the coast of Sicily, their last and furthest important possession—in natural gifts, and in acquirements of art, most excel all other neighbouring nations. Of Sicily, where, according to Diodorus, the wheat-ear and the vine-cluster grew wild; where Hybla poured forth its fragrant honey; where, in the plains of Enna, the perfume of the violet made the dogs lose their scent; where Theocritus, from the familiar converse of the country swain, perfected bucolic poetry; where the vats of the vintage were the cradle of the Comic Muse; where rose Thespis the father of Tragedy, and

died Æschylus its first lawgiver; where Archimedes flourished and Euclid taught, the varied outline presented an uninterrupted series of the most superb cities, and to this day the coins form the chief boast of the antiquary.

The regions between the Caspian and the Euxine, to the south of Caucasus, seem to have been the first birthplace of the Greeks. Thence first advanced westward their progenitors, those Scythians, those Pelasgi, and those Hellenes who, coasting both shores of the Black Sea, the northern and the southern, at last settled partly in Ionia, partly in Greece Proper, and partly in the intervening islands, still occupied by their degenerate descendants; and thence sent their colonies still further westward round the shores of the Mediterranean.

In the regions whence they first originated, and where their blood may be supposed to have been least alloyed and degraded by subsequent remixture with that of inferior races, it still retains, to the saying of all witnesses, its full physical superiority. To this day the Circassians and the Georgians boast of features, in more regular proportion filling the fine oval of their face, of a head more beautifully implanted on a chest wider and higher, rising out of a waist slenderer and more taper; of limbs more full, elastic, and fined down; joints and articulations more firm, and yet more flexible; extremities more deli-

cate, pointed, and curling; complexions by nature more clear and transparent; hair more silken, more jetty, more trimly traced round the features; bodies better poised, and by the least impulse of the mind more easily set in motion; carriage more lofty, light, and buoyant; gait more easy, firm, and graceful; countenances more expressive and more full of fire, than fall to the lot of surrounding nations; and these fascinations they still retain in their genial regions at so much later an age than elsewhere, as not to render incredible the period to which Homer extended the beauty of Helen, or to make the age at which still glowed the ardour of Anacreon, appear in Greece an exaggeration of poetry.

In frames formed of a clay thus fine, cast in a mould thus perfect, must have arisen organs of sense capable of impressions the most delicate and most diversified.

And in fact the ancient Greeks evinced the superiority of their organization by surpassing in every bodily display every other nation. Among them individuals of every age and station alike frequented the gymnasium; all were equally proud to excel in the more arduous games of the palæstra, and in the more elegant movements of the dance. Saltatory motions were not in Greece confined only to one sort, and only marked by one character. The young and the old, the grave and the gay, each had the choice of

metrical movements suited to their rank and station. While the warrior delighted in the bold abruptness of the Pyrrhic step, the courtesan displayed the languishing movements of the Lydian measure: even the philosopher took his part in the maze with a grave and decorous dignity.

Thence also the art of flattering those twin senses, the palate and the scent, were carried in Greece to the highest pitch. The cook, the confectioner, and those females whose business it was to assort the flowers of the richest hue and most fragrant perfume in the wreaths and chaplets worn at all festivals, were in no country more celebrated. Thence, above all, the finer ear of the Hellenes refined the ruder language of the Pelasgi so rapidly, that already in the age of Homer, the earliest of recorded poets, and in that of Herodotus, the oldest of heathen historians, the Greek tongue excelled all others in abundance of words, richness of phraseology, number of tenses, simplicity and copiousness of conjugations and declensions, variety of dialects, fulness, contrast and euphony of sounds, melody, harmony, rhyme and cadence; that in Greek composition, even where the sense of a phrase would have fallen flat on the mind, the elevation of the sound still sufficed to support it to the ear, and the fulness of that sound disguised the feebleness of the sense; and that Horace, no mean artificer in his own lan-

guage, and with his own tools and materials, feelingly deplores the inferiority of the Latin to the Greek language. The nicely turned ear of the Greeks even went so far in its susceptibility as to have obscured history, by remodelling into terminations more harmonious the harsh endings of barbaric names; and Socrates urged the importance of bestowing on children such appellations as might excite them, when men, to act up to, in all their concerns. From the extreme susceptibility of the Greeks to rhyme and cadence were among them all the arts capable of displaying its charms—dance, song, the clang of instruments, acting, recitation, and pantomime, nay oratory and history themselves—comprehended under the collective denomination of music, placed under the patronage of goddesses called muses, and often made to go hand in hand, and to co-operate in one single great joint effect. Ode, elegy, hymn, and other poetry epic and dramatic, always accompanied by appropriate chorusses, by instruments, and by dumb show of the most expressive sort, ever spoke alike to the ear and to the eye, the sense and the mind. Nothing was addressed to the cold reason, that had not previously been made to excite and to warm the imagination. Such power indeed had in Greece music over the fine strung minds of its natives, that according to Greek historians the nature of the musical instruments and the

mode of musical compositions not only excited the transient passions, but influenced the permanent character of its different republics. Polybius attributes to the neglect of music the ferocious disposition of the Cynetans, and to the sedulous cultivation of music the softening of Arcadian rusticity. Aristotle, in the education of youth, urges with equal earnestness the practice of gymnastics and the study of music; and not only historians and philosophers—a Plato and a Theophrastes, a Strabo and a Plutarch—but even legislators and rulers enforced in their commonwealths the study of music, nay made it a point to promote the cultivation of peculiar modes, and the exclusion of certain others;—to keep a watchful eye over every innovation and change, whether in the construction of musical instruments, or in the character of musical compositions.

The[illegible]while in ancient Rome the science of music was abandoned to slaves, in ancient Greece a want of musical skill was in the highest citizens deemed disgraceful. Amousikos, or unmusical—a term implying a deficiency either of natural fineness in the organs of sound, or of proper cultivation of their capabilities—became a term of bitter reproach. Thence Epaminondas was, by his biographer Nepos, praised for his proficiency, not only in dancing, but in playing on the flute: and Themistocles was, on some oc-

casion, deemed ill educated for not knowing at a festival how to strike the lyre. The Greek diatonic or musical scale contained modes and subdivisions of tone and measure more numerous and more minute than modern ears can discern. Vitruvius complained of not finding in the Latin language terms capable of rendering the Greek musical system of Aristomenes: Greeks were the inventors, first of the lyre in all its varieties, and later of the organ. From Greece came all the terms of music, vocal and instrumental, afterwards used in the Roman ritual; and thence do we find, like the language, the music of the Greeks branch out in so many different ramifications, that its tendrils seemed to entwine themselves with every affection of the mind, and to give the impulse to every movement of the body.

From the extreme power which beauty, corporeal as well as mental, exerted over the sense and mind of the Greeks; from their extreme sensibility to the impressions of the one as well as of the other; or rather, from an idea that a certain degree of perfection in the external forms of the body always implied a certain corresponding perfection in the internal faculties of the mind—that even the former cannot, by nature, have been given in an eminent degree, except to such as the Deity looked down upon with complacency—not only the common class

among the Greeks, but even their sages, their philosophers and their lawgivers—a Lycurgus, a Solon, a Socrates, and a Plato—placed corporeal beauty among the foremost of the gifts of God, and of human blessings, and as on a par with the privilege of superior understanding, regarded the possessor of superior beauty as being equally with the possessor of superior wisdom a special favourite of Heaven; almost paid its owner divine worship, and raised to his memory not only statues but altars.

No wonder then that the sage as well as the gay, the artisan as well as the artist, from motives of utility as well as of pleasure, should not only have studied to the utmost the beauties of nature, but should have striven to enhance these by all the combinations of art which the fertile imagination of the Greeks could suggest: nay, that they should, of the perfections, in the originals of nature only beheld dispersed very widely among individuals very different, have in the mind collected the ideas in single intellectual wholes, thence called *ideal*, before they executed of these mental combinations the external representation; and that they should thus have arrived at producing, of the beauties of nature, physical and intellectual, imitations, singly more striking than any prior originals ever beheld. Indeed the Greeks considered the arts of design, which lead to the study and knowledge of the

perfections of nature, and their improvement by art, in whatever is connected with the forms of utility, of comfort and of pleasure—with the institution social, political, and religious of individuals and of states—as of such importance to general welfare and happiness, that not only Aristotle in his imaginary republic, but the legislators of Greece in the real commonwealths which they regulated, made the study of those arts an indispensable part of the education of every free citizen, low and high; and distinguished them by the name of liberal, as being, by their very tendency to exalt the mind, forbidden the slave, whom Grecian policy kept down.

In every pursuit of utility and of pleasure; in agriculture, in manufactures, in mechanics, in architecture, and in navigation; in music, painting, sculpture, oratory, history, and poetry; in the arts of peace and production, and in the arts of war and destruction, the Greeks excelled alike in each line of pursuit. Their capacities were as versatile as they were extensive. In each branch of art, from the rudest beginnings, they made, in the shortest period, with the least adventitious aid from without, the furthest and longest strides; in each attainment they reached unassisted the highest pre-eminence. They invented most, perfected most, most surpassed whatever preceded them, and most served as in-

structors, as examples, and as models to the nations that came after them. For in comparing the advancements of the ancient Greeks, particularly in science, with those of modern nations, we must always keep in mind the very unequal point of departure whence each first started, the later nations that signalized themselves by their progress, having had the whole stock of Greek lore to begin with; nor infer any mental inferiority in the Greeks, only from their having attained a less degree of ultimate eminence in those branches of knowledge, which, demanding mere observation and experience, must ever necessarily, as the world grows older, by the last comers be collected in greater quantities. In the fine arts, in which success depends more on inspiration, on native fire, and less on patient inquiry, so far from modern nations having outstepped the ancient Greeks, they have sensibly retrograded; and we no longer can enter into competition with what Greece admired two thousand years ago.

Not only in the productions that occupy the sense in their enjoyment, but in those exclusively addressed to the mind, did the Greeks far surpass all neighbouring nations. If Vitruvius complained that the Romans had no terms for rendering the musical expressions of the Greeks, Cicero equally lamented that the Roman language was deficient in means of expressing Greek

metaphysics. Of the various philosophical sects which arose in the fertile soil of Greece, few only were able to carry on, in the character of exotics, a feeble and lingering existence at Rome.

From the versatility of Greek genius, it was not an uncommon thing in Greece to see the most exalted personages shine with equal brilliance in accomplishments the most opposite.

I shall not here state the numberless instances mentioned in history of artists equally eminent in architecture, in painting, and in sculpture. The union of opposite talents was carried a great deal farther. Almost every great historian had begun by acquiring personal distinction in the scenes of valour and of prowess he describes. Each was a practical statesman before he became a political writer. Arts, literature, and philosophy mostly went hand in hand. According to Plato, nature had fitted Solon to be a successful wooer of the muses before he became a worshipper of Themis. Plato himself applied with success to painting and to poetry, as well as to philosophy, and was trained to athletic exercises by Aristo of Argos, at the same time that he was initiated in the study of letters by the grammarian Dionysius. Æschylus signalized himself in the battle of Marathon before he became an eminent tragedian. Pericles was as good a judge in arts as he was expert in matters of state. Alcibiades excelled in music and in dancing, before he be-

came a popular leader. Socrates was a sculptor by profession, and had distinguished himself in war against the Spartans; nay, had studied eloquence under Prodicus, poetry under Comus, geometry under Theodorus, and music under Damo, before he became the most celebrated of heathen moralists. Epaminondas showed as much skill in the command of his flute as in that of his army. Xenophon was as great a writer as he was a general. And when the Roman commander, Paulus Emilius, after his victory over Perseus, king of Macedon, applied to the Athenians for a philosopher to instruct his children, and for an artist to paint his triumphs, they provided him with both in the single person of Metrodorus.

Forcibly impressed with the shortness of our present existence, and having feeble assurance only of a life hereafter, the Greeks seemed always trying to condense as many agreeable sensations in as short a measure of space and time as possible: to live as fully as they could, while life lasted. Their artists, in general, condensed all their powers of striking the imagination in a single action; their authors in a single event.

Their dramatic representations, though uniting all that could impress the sense and mind in a single whole, were always short and terse. Their orators, instead of diluting their arguments in a mass of words, and only by numerous convolutions gradually approaching their object, went

at once, in the most rapid way, straight to the point. They found not time for long exordiums and preparations: their logic resembled a full, deep, and forcible current, running down a precipice, which nothing can resist: and when Phocion, the powerful adversary of Demosthenes, was asked, ere he commenced his speech, why he looked so thoughtful, "It is," he answered, "because I consider how to abridge what I have to say."

Where, in every path of distinction, so many sought fame, for any one to excel was an arduous task. Yet so liberal was in Greece the reward of merit, where it inspired not distrust, as in every species of pursuit to produce the utmost emulation. "O Athenians!" exclaimed Alexander, "how I toil, only to obtain your applause!" And the greater was the superiority of the Greeks over other nations, the more willing it found them to do their rivals justice. It is true they called the races not of Grecian blood Barbari; but with them this word had in it nothing of contempt or disparagement. It only was used as synonymous with that of foreigners. The real inferiority of the nations to whom it belonged has since affixed to it a meaning more unfavourable. Of the history of the nations called Barbari, we only know, besides events related in the Bible, what the Greeks have recorded of them. No people were readier than

they, not only to receive improvements from strangers, but to proclaim the obligation.

The Greeks felt a constant wish to please. The gratification they saw depicted in the countenances of their admirers seemed to be reflected in their own features. Thence the easy urbanity that distinguished their address. Nor was their courteousness confined to their fellow-citizens. It extended to every stranger that visited their shores. The lower classes displayed its refinements as well as the higher orders. The volubility of their mind gave their conversation that elegant sprightliness, that condiment, become proverbial under the name of Attic salt. Their flexibility of organization, bodily and mental, made them with facility adopt the manners, however different from their own, of those among whom they resided. The sturdiest patriots at home became the most obsequious courtiers in the palace of a Persian satrap. After they had been conquered by the superior force of the Romans, they in their turn subdued their conquerors, by the pre-eminent powers of their intellect. With those very same arts and sciences with which they adorned the reigns of the Roman emperors, they more lately again illustrated the courts of the Mohammedan kaliphs. Under every misfortune still preserving the elasticity of their mind, the mirthful mood of their disposition, their latest descendants still betrayed their re-

lationship to those Lydians who, when by the siege of their town reduced to a state of famine, invented new games to beguile the pangs of hunger. Cruel when in wrath, like all nations so constituted that political contests become personal struggles for life or death, they yet were the first to render sacred the character of supplicants, and to raise altars to Pity; and, to their honour be it spoken, to the last they resisted the introduction of those sanguinary spectacles, which deluged the Roman amphitheatres with blood.

In no circumstance did the capacity of the ancient Greeks show its extent, and their disposition its pliancy, more than in the diversity which difference of localities, situations physical and moral, institutions and laws, produced in the characters of their different individuals and states; than in the readiness which they showed under every different pressure, to assume every corresponding form, and to adapt themselves to every situation.

While in inferior human races, first on this globe by the preponderance of some peculiar element produced, such is of that organization the inclination and bent in some peculiar direction, that the disposition with which each individual is born clings to him during life, nor from any subsequent difference of situation derives any diversity of remodifications, any difference

of subsequent developement; while these inferior races suffer the longest periods of time to roll over their existence, without experiencing from them any change in their first impressions; while the negro, from an infant to an elder, whether within the tropics, or cast near the poles, still equally is in mind and manner either an abject slave or an imperious despot, so that each might exchange stations with the other, and yet not display any difference of character, except what proceeded from difference of relative situation, the Greeks, from the slightest variation of external circumstances, suffered a remodelling of internal disposition so entire—found the different faculties of their sense and mind checked or developed in degrees so different—that the smallest extent of country which offered climates, localities and situations dissimilar from each other, already offered inhabitants equally contrasted in habits and in disposition; in powers natural and acquired: that the small circumference of Greece Proper alone exhibited individuals and states, more diversified in forms, in institutions, laws, customs, and manners, than elsewhere the widest regions could exhibit. A short day's journey sufficed to compass the opposite extremes from the height of rustic simplicity in Arcadia, to the height of urban civilization, luxury, and polish in Corinth; from the austerity of Sparta, to the elegance of Athens. Nay, in the same spot, the

most striking oppositions, the most sudden contrasts presented themselves side by side. In the gymnasium or the stoa might be seen, in familiar converse, the athlet, in whom only the body had received the utmost developement, the mind been left fallow, and the philosopher, whose mind had received the utmost cultivation, even at the expense of the body; the trader in the substantial articles that gratify the sense, and the sage who only dealt in, and only brought to market, intangible opinions; the landsman and the sailor; the modest matron, gliding unknown athwart the busy crowd, and the brilliant courtesan, on whom were riveted the eyes of all Greece: Democritus clothed in perpetual smiles; Heraclitus constantly dissolved in tears: Aristotle teaching philosophy in the garb of a prince; Diogenes proud of his rags: Zeno, Epicurus and Plato, inculcating doctrines as distant as the poles asunder.

Still must it be owned, that even the mind of the Greeks, with all its capabilities, hardly possessed the extent necessary to admit the highest abstractions: that if Cicero in his philosophical works evinces no originality, and only puts forth certain of the tenets previously broached in the schools of Greece, even the Greek philosophers themselves, in their turn, only retailed the shreds and patches they had earlier picked up, of a doctrine, of which the more connected whole

must at a more remote period have first existed further eastward.

Among the instructors of the Greeks, originating from the more distant realms of Asia, the first seems to have been that Dionysius or Bacchus, not yet in the age of Homer raised to the rank of a god, whom the Greeks describe as having returned from his travels to India fraught with the wisdom of its schools, and attired in the garb of its sages. He presents, in character as well as in name, a marked identity with the Indian god Baghessa. The same mystic symbol of fertility, the phallus, wrapped up in a tiger's skin, being in the festivals of both carried in solemn procession, followed by a motley crowd of votaries of either sex, performing the most frantic gestures and movements.

Another of the strangers, who came early to instruct the Greeks, was the Thracian Orpheus, who likewise brought from India the philosophy of the gymnosophists, and taught that all things first emanated from, and after a certain period again were reabsorbed into the bosom of the Deity. Among them also was the Phrygian Antisthenes, the Phœnician Thales (different from him of Miletus), and the Chaldæan Berosus, who in the time of Alexander established at Cos a school, where, among other things, he taught that the tenth king of Chaldæa, by the order of Saturn, built a vessel, in which he shut him-

self up with his daughter during a deluge, of which he ascertained the subsiding by letting out birds.

Among the Greeks themselves, who in the schools of more ancient nations sought what scraps of more eastern doctrines the priests of these earlier nations could be prevailed upon to disclose to them, were the Athenian Musæus, himself a disciple of Orpheus, who went to consult the wisdom of Egypt, and Pythagoras, who pushed on to Phœnicia, to Persia, and to India; and who, as far as the tenets of a sage who never imbodied his doctrine in writing, and whose disciples were enjoined the greatest secrecy, can be ascertained, from the gymnosophists or Brahmins of India adopted the physical doctrine of the centrality of the sun, and the metaphysical doctrine of the unity of the first cause, whence first emanated that soul which successively animated different bodies. Among them was Cleobulus, one of those men called, by a pre-eminence, no longer accounted for by any peculiar facts, the seven sages of Greece; Solon, the lawgiver of Athens; Plato, who, as well as the historian Herodotus, visited the learned men of Egypt; Democritus, who conversed with the magi and the Chaldæans; Anaxarchus and Callisthenes, who accompanied Alexander to India; and, finally, Apollonius of Thyana, who, even after the birth of our Saviour, travelled to consult the magi of Babylon and the priests of India, besides

all the Asiatic Greeks, who, standing in natural allegiance to the kings of Persia, had daily opportunities of rendering themselves conversant with the creed of eastern countries.

And not only some of the eastern mythological traditions of the Greeks—such as the struggle between Jove and the Titans, at last ending in the total overthrow of these inferior and rebel powers, hurled into the fiery furnaces of Etna; that of the deluges of Ogyges and Deucalion; and that of the first human beings, brought forth after the former submersion of the globe, perishing by each others' hands—offer so striking a coincidence with some of the first incidents related in the Bible, but even certain expressions occurring in the later dialogues of Plato, present with certain still later terms in Scripture so marked a conformity, that it is difficult to suppose the Greeks not to have had some cognizance of the sacred writings of the Jews.

But whether this was the case or not; whether the Greeks had or had not any communication given them of any of the higher truths by degrees divulged to the Hebrews, so discordant was with these truths the general tenor of Greek mythology, that, instead of the purer doctrine of the east finding in Greece a general acceptance—instead of its becoming the property of all—it remained concealed from the vulgar in the inmost recesses of the temples, and only under the name of mysteries, unfit for the profane ear, and under

the oaths of the most inviolable secrecy, was revealed to a few among the higher orders.

As entities raised highest, when their tide turns, fall lowest—as the very volubility of the Greeks, which made them advance more rapidly, when the impelling force failed, allowed them to retrogade faster—of that very nation once so great, so glorious, the remains, when subdued by, when remixed with, when corrupted by other nations of an inferior caste, lapsed into a state of degradation more complete than other nations, displaying a greater *vis inertiæ*, would have done. All the elements of good, blended in them, decomposed more rapidly, and emitted a stronger taint.

Though I have pointed to the east, for the origin of the doctrine, higher than that of the Greeks, which these received, but did not know how to value, and to render fruitful, I am far from believing that even among those eastern nations to which we can more proximately trace its higher tenets, these first took their birth.

When among all those nations more early civilised than the Greeks, from whom these latter borrowed their philosophy and their religious creed, we find of the tenets most sublime, fragments not only most similar, but most equally deprived of their connecting links, most equally intermixed with absurdities the most glaring, the most incapable of proceeding from the same mind that could first have conceived the former;

when we find that all these nations equally concur in concealing the sublime truths they chance to possess from the knowledge of the vulgar, in a way they could not have attempted—not have wished to do—had these truths been by the vigour of native intellect discovered on the spot; and find them trying by their exclusive possession only to enslave that vulgar, instead of wishing by their general dissemination to enlighten the world; when the depositaries of these recondite truths seem among all these nations equally anxious to cast an anathema on all men not purposely initiated, who should disinterestedly search after knowledge, it is but fair to suppose that, as little as the Greeks themselves, those earlier eastern nations, from whom the Greeks more proximately derived their higher doctrine, were those among whom its light first shone; who first found it illumine their breast. It is but fair to suppose that even these more eastern nations, of which records still subsist, only retained what they boasted of, or rather concealed, as scraps and remnants of a body of science better connected, only possessed in its whole concatenation by some race earlier and higher, again, by some of the dire deluges that afflicted this globe, almost entirely overwhelmed, of which by other inferior races the scattered remains were picked up, preserved, and, together with their own baser alloy, transmitted to their later descendants.

CHAPTER XXXIX.

Is independence, is free agency, is liberty necessary to pleasure, to enjoyment, to happiness?

That pleasure, that enjoyment, in time and in space sufficiently continued and extended to deserve the appellation of bliss, of felicity, of happiness, are and must be the aim of man's actions here, and the object of his hopes hereafter, can admit of no doubt; but a great question, now much agitated, seems to arise from every part of my inquiry, or rather, in my own opinion, to be by that inquiry settled in the minds of those who have throughout attentively followed my arguments: namely, are independence, free agency, liberty, or are they not, the immediate and direct conditions and means of man's felicity and happiness? have either of these states essentially or immediately any connexion with happiness? is happiness not to be obtained without them?

First: let us understand what is meant by independence, by free agency, by liberty. I believe these to be conditions in reality very different.

Independence, free agency, are positive attributes, which man cannot possess. He de-

pends, more proximately, for what he is, for what he can do, or even can will, on prior external circumstances, that formed him, that place him in the peculiar situation he occupies on this earth, that cause in him the peculiar sensations and thoughts he experiences, that modify and that direct these sensations and thoughts, that permit him to have some, and prevent him from having others. He depends more remotely and ultimately, for all he does and all he is, on that Creator who willed all the conditions and circumstances of his actions and of his existence. No man has free agency, no man even has free will; for the will of man is an impulse outwards, which depends on prior sensations from without inwards, and on thoughts produced by these sensations, previous to that will.

But what is understood by liberty is not, like independence, like free agency, a positive attribute, liable to no degrees, and inadmissible in any thing created of which we have cognizance. It is only a relative attribute. It is only the power in man of performing what he has the previous power of willing. It is only in each individual man restrained by the power of other individual creatures of God's creating—of other productions of nature—distinct and separate from that individual man, and not directly connected with him, without or with a volition of their own, to check that individual in the actions proceeding from his will. It consequently has infinite different

degrees of restrictedness or of extension. A slave under an indulgent master may enjoy liberty to a certain degree, and the man, nominally freest, in the republic said to enjoy the greatest liberty and equality, but where the population is very dense, and where every other individual, like himself, employs his liberty, exerts his power, to thwart him, will continually be crossed and jostled; will continually have his elbows pinned to his sides; will live in a continual state of servitude and restraint. We need, therefore, no longer waste any time in inquiring whether independence, free agency, are essential to man's happiness. We know that no man can be independent, can be a free agent; and yet we know that many people have great enjoyment, great happiness.

But we may inquire whether a certain modified degree of liberty is necessary to man's happiness, and what degree is necessary to the same.

To answer this question satisfactorily, we must begin by investigating what is pleasure, what is enjoyment, what are the ingredients of which a certain quantity form the aggregate called happiness—whence enjoyment and happiness immediately arise?

The actions we perform, the impressions we in our turn make on other entities, and of which the earliest—caused by prior impressions first received by us, from prior impulses first given to us, by prior actions first performed on us, by

other entities, forces, powers—already begin, while we still only possess a faculty of again transmitting the impulse we blindly receive, as blindly, and without any consciousness of doing so to others; already begin, consequently, long before we are capable of harbouring any sensation, of experiencing any enjoyment, of feeling any happiness; and to the last from us that perform those actions, that cause those impressions, they only go out, only produce sensations, only produce happiness, immediately in certain of the other entities by whom these impressions are received—if these entities have the faculty of drawing from the impressions they receive any sensation. They are only immediately received by other entities, in as far as those other entities, with regard to those that give the impressions—that are active with respect to them—are on the contrary passive.

If we ourselves receive impressions, receive sensations of pleasure, of happiness, from other entities acting upon us, it is only in our capacity as acted upon by these other entities, as passive with regard to them, that we receive those sensations of pleasure; that we are immediately made happy.

Nay, if by our actions performed without our prior will, or even by our actions impelled by our own prior will, we procure ourselves any pleasure, and add to our own happiness, it is only as by our agency with regard to modifications with

regard to which we are active, we so impel these modifications that they in return are in a circle made to impel and impress us, and to render us passive, that they thus are made mediately to cause in us the impressions which give us pleasure, and which afford us happiness.

If without our will, or even directly through our own volition, we derive any enjoyment from the sense of feel, of taste, of smell, of hearing or of sight, it is not immediately from acting on other substances, modifications, or persons, that we derive that enjoyment from those senses. These other substances, modifications or persons, are only the intervening means and instruments, through the medium of which we again more remotely obtain that pleasure, that happiness. It is from placing these modifications relative to us, or ourselves so relative to them, in such a position, that they may in their turn react on us—on our organs of feel, taste, smell, hearing, or sight—that they may give these organs certain impressions, that they may be active with regard to these organs, and render these organs passive with regard to them, that they are enabled to produce in them sensations of pleasure.

It is the same with pleasures, with enjoyments, with happiness of an intellectual sort, as with those merely sensitive. All those mental pleasures which we receive, from the lowest to the highest, proceed immediately and directly, not from the actions which we perform, and

with regard to which we are active, but from the impression made on us by the actions of others; from the impressions we receive of these actions on us, and with regard to which we are immediately passive. They proceed immediately from our passive state, whether previously by our own actions we ourselves caused this subsequent passive state, or whether it arose independent of any prior action of our own, and only from other causes.

And the highest pleasures we can conceive, as coming from impressions made upon us, and with regard to which we are passive, are precisely those that we receive from impressions produced in us, unmixed with, unpreceded by any actions, any trouble whatever of our own, and leaving us entirely and unmixedly acted upon; entirely passive, entirely contemplat[illegible]

They are such pleasures, such happiness, such felicity, as the sense and the mind receive from the contemplation of beauty; from the gratification of our curiosity, when our sense and mind are applied to objects capable of feeding their appetite, their voracity, by the nutriment they afford, by the information they give; by the discoveries of science, by the acquisition of knowledge.

The pleasure which the eye receives on beholding, on being penetrated by, on receiving impressions from the radiance which is transmitted to it by a beautiful, a sublime external ob-

ject, and the delight which the mind experiences when, through the channel of the eye, the cause of this impression penetrates to that mind, and enlightens its curiosity, gives it increased science, increased knowledge, are the direct consequence only of a passive state—a passion in those that feel it: they are only the latter and more remote effect of a prior active state, or action of the elements that give it.

It is thus evident that all enjoyment, all happiness, all felicity, which even man, an entity partly active and partly passive, can feel, arises only more mediately and remotely from the actions involuntary or voluntary which he performs, in order to receive pleasure or happiness. That it only immediately and directly arises from the impression which other things make on us; which things, not willed by us, often make without our intending it; and which things which we intend to give us pleasure, often fail to give. In other words, that pleasure, that happiness arise not directly from our actions, our power, our force, our impulse given to others, our liberty to move them, but, on the contrary, only from our subjection to the power of others; from the impulses, the movement, the impression these others give us; not from our active but our passive state.

Indeed, as soon as an entity becomes capable of being by any other surrounding entity—whether that other itself having any will or any sensation,

or as yet deprived of the faculty of receiving any such—so acted upon, so impressed, so rendered passive as to become capable of sensation, we know that it already becomes capable of feeling pleasure, enjoyment, happiness.

Even while, under the name of a mere brute, an entity is still only capable of impressions or of pleasures of the mere external sense; while it still is incapable of receiving through the organs of the sense any impressions of the mind, or at least any impressions of the mind sufficiently intense to be called intellectual pleasures; while it has not organs, faculties, ideas of the mind sufficient to give it a variety, a choice of desires—an option which of its different desires to execute in preference to others; while it still has not yet what man calls free will, free agency, it already is capable of experiencing pleasures very intense and often very varied.

Who shall deny that a horse, a sheep, a bird, a butterfly, already are capable of enjoyments very intense and very prolonged, though they have not yet any liberty of acting, or even of willing; though they still are only yet the unwilling slaves of their desires, their sensations; though their actions, even already voluntary, are not yet free?

Who shall deny that man, who is capable of adding to the enjoyments of the sense those of the mind, who is capable of feeling in that mind, as in the sense, the grateful titillation

which he derives from the contemplation of beauty, from the acquisition of information, of knowledge, of science, of foresight, of the impressions which external events, entities, elements, and modifications, still future, may by anticipation make on his mind, is capable of receiving from the impressions he experiences, pleasures and enjoyments infinitely more extensive, durable, and crowded than those of the mere sense, which nevertheless only derive directly from his passive state?

And the more man acquires knowledge of former impressions made on him, and of sensations and thoughts, by these impressions excited in him, the more with that knowledge, and with the consequent power, by his reactions on surrounding modifications, and through the medium and instrumentality of these surrounding modifications, in return, by a circle, on himself, to produce impressions on that self which add to his passiveness, the more he adds to his capability of receiving pleasure and happiness; but the more at the same time he also adds to his subjection, his liability to be impelled, influenced, swayed by prior surrounding modifications; the more his will, his actions with regard to others, and through the medium of those others, his more distant impressions again in their turn produced on himself, must diminish his liberty, must induce in him subjection, even to his former self;

must, it is true, render his fetters less heavy, perceptible, but more numerous, more varied, more on all sides surrounding, and confining, and binding his will. Instead of only being like the brute, swayed by a few very evident considerations, he becomes impelled by a number of different and often contradictory views, of which the most powerful, and most intensely affecting him, at last alone gains the preponderance. While the brute is only impelled by the force of instinct, man is impelled by the additional stimulus of all the faculties that constitute his reason.

We know that man, though at first hand by his God, his Creator, made to do all that pleases that Creator—though with regard to that Creator wholly and solely subject—may often experience great enjoyment, great happiness.

Nay, we cannot conceal from ourselves that many individuals, even entire nations, are at second hand despotically governed by human despots,—are as yet destitute of any degree of what is called liberty,—and still in the main are very happy, very contented. We know that as long as the despot knows what is good for the nation he rules, and as long as he wishes that good, the more despotic he is, the more he can effect that good. He even saves others the trouble of thinking, of acting for themselves, before they attain benefit and enjoyment.

Nay, in a despotic government, even if the

despot swerves from the best dispositions respecting his subjects—if he becomes an oppressor, a tyrant—his single weight can only press hard on a few individuals immediately surrounding him. It requires infinite study before oppression can be so organized as to descend in regular gradation from the highest orders to the lowest; and this very study leaves a constant chance of events by which its effects may be counteracted. Even in Turkey the mass of the population is contented and happy; and what more can man wish for? But, on the contrary, in a government in which there is, in a great many individuals, a great deal of freedom, even of licence, a great deal of equality, a great deal of power over a great many others—in which a great many individuals have great means of annoying others—in which, consequently, as there is great power there must also in turn be great subjection, there may be great suffering, great unhappiness, great misery. And such existed anciently in the Greek commonwealths, and in the middle ages in those of Italy.

While the impressions made on man, and which render him passive, are good, are beneficial to him, they make him happy in spite of his want of liberty; nay, the less liberty he has, —the less his impressions are owing to his own prior voluntary actions, the more they are the

mere effect of contemplation—and the more they will, even here, produce his unmixed happiness. It is even on this globe only while the impressions, made upon him by the power, the action of other individuals, are evil, are noxious—while his passiveness leads to suffering, to unhappiness —that a certain comparative degree of liberty is of advantage, in enabling him to withdraw from a yoke too heavy; and to seek another less galling.

As long as on a narrow globe like this a great many individuals, still each wholly distinct and separate from each of the rest, and each nevertheless very close wedged with each of the rest, each have in turns an equal liberty, a licence, a power, a faculty of pushing, of pressing upon, of annoying, of interfering with the rest, this excessive power in each over the rest must needs in its turn in each individually alternate with a subjection, a slavery to the rest very great, very frequent, very sudden, and often very painful; and, as on such a globe the separate individuals become more numerous and close wedged, the more frequent must also in each become the moment of excessive and painful subjection to certain others. It is only on a globe whose different individualities are so blended as to render the action and pressure of each individual over each of the rest less partial, more even and general, that the subjection of each to the action of each of the rest can be felt only as

a pleasure, an enjoyment, a means of happiness, destitute of all mixture of pain. But this circumstance renders liberty a mere means of escaping from evil in this world: not a means of happiness, to which we should look as desirable in a life hereafter. In a future existence we shall probably have our liberty, by all that surrounds us, still from a greater distance in time and place more completely checked and hemmed in; shall be more generally acted upon; shall more only return outward impulses, which we first only from without received; shall be more passive before we in turn become active; and shall, consequently, with less liberty to do evil, with greater confinement to good, be more happy.

Is not the pure contemplation of what from the furthest space withoutside us impresses our sense, and through our sense impresses our mind —of what in space withoutside us has happened, and what, from the necessary reaction of the past over the future, from the necessary connexion between the two, is still fated in space withoutside us to happen—is not the receipt of the radiance that from all surrounding points of space proceeds to us as to its common centre and focus, and gives us an insight, a knowledge, a science of events and modifications gone by, and through the medium of those events and modifications past on us, and of the impressions they necessarily make on us, also give us an insight into

events still to come—is not this contemplation, and the insight, and knowledge, and science resulting from it, of all around, past, and future, when and where least intermixed and blended with the trouble, the anxiety, the pains, the uncertainty of bringing it about; and when no longer coming in such partial excess and preponderance as to bring pain and trouble with its pleasure—as to become irksome and painful—when entire, unmixed, unconfined, clear, unlimited in time and space, the pleasure, the enjoyment, the happiness, most intense, most pure, most unalloyed, which we can conceive, even here; and is not this a pleasure, deriving immediately, and directly, and solely from impressions which are, with regard to us that receive them, purely passive; and can we as yet conceive here, or hereafter, any happiness, greater, or more divested of trouble, of irksomeness, of pain, than the feelings we can receive from this pure and perfect passive contemplation?

CHAPTER XL.

What is meant, what is understood by the word individuality? and how can the very same individual be both active and passive, not only with regard to other individuals different from itself, but with regard to other later and different parts of its own collective self?

By the word individual is fundamentally meant and fundamentally understood an aggregate of a certain quantity of contiguous portions of time and space: all sensation, all idea of individuality rests on that of a certain quantity of contiguous portion of time and space. All sensation, all thought, of later and more partial individualities, sensible or intellectual, are included in the sensations or thoughts of certain individualities in time and in space. But the sensations and thoughts of time and space themselves, however restricted we may feel or think them, can always be, in the sense and mind, in further time and space, divided in other smaller portions of the time and space, of the combinations of which they are composed. All individual consequently, composed in time and space of lesser portions

successive of time, and of lesser portions simultaneous of space, may singly and individually offer a twofold capacity; stand in a twofold aspect; may, in some of its successive component parts in time, and in some of its simultaneous parts in space, act upon other parts later and different; and in some of its parts later and different be acted upon by other parts earlier and different; be singly and individually both active and passive. An individual may not only act upon and be acted upon by another wholly different individual. An individual may in a circle, in time and in space, act upon and be acted upon by—be both active and passive with regard to—other portions of time and place different from others, composing parts of its own single collective individual self.

Of course, when the Almighty power, out of the attributes and modifications, at first all insentient and unthinking, in which the creation seems to have begun, willed to arise individuals, which with some of the impressions they received from other contiguous individuals also of these impressions received from these other individuals feelings and thoughts, and to arise individuals which, with some of the impressions they gave to other contiguous individuals, also of these impressions give these other individuals feelings and thoughts, these individuals singly continued active with regard to those other in-

dividuals, and to those other parts of the same individual when, in a circle in time and space, they, by their earlier impressions, produced in these others and in themselves sensations and thoughts of these impressions; and became passive when, in that circle in time and in space, they received, with these impressions, sensations and thoughts of them.

And whether, as on this more restricted globe, fewer parts, simultaneous and successive, are blended together in a single individual, and more separate smaller individuals, simultaneous and successive, are left separate; or whether, as we suppose will be the case in another and roomier globe, more parts simultaneous and successive be blended together in fewer and larger distinct and separate individuals, still must, as long as time and space continue to last, and to be composed of a continuation of lesser parts, these individuals each remain singly and individually passive with regard to what preceded them and caused their existence, and the impressions, and sensations, and thoughts they receive, and active with regard to what follows them and causes the existence they in their turn give to other entities, or in a circle, to other later parts of their own individual entities.

In this narrow and confined globe the different attributes and modifications are so crowded that they often interfere with and check each other;

that their impulses, their actions, their movements, their impressions, stand in each other's way; that they prevent each other, and thus cause a friction excessive, and instead of only, where they occasion sensation and thought, producing sensations and thoughts of pleasure, by their excess producing sensations and thoughts of suffering and pain.

But in another world, where there is more elbow room, all its actions, impulses, and movements, finding more space and more time to extend in, and becoming more proportionate, more harmonious, and more free, both from deficiency and from excess, will alike only enable the producer to produce, and the receiver to receive enjoyment and happiness, unmixed with any remains of suffering and pain.

In proportion as a greater number of lesser separate individualities are blended together in a single greater individuality, this greater single individuality must directly become both more extensively passive to all that surrounds it, and more extensively reactive over all that surrounds it.

CHAPTER XL.

Pause!

HAVE I sufficiently explained my idea? Have I said clearly enough that unless all analogy fail us, unless all progress from the past to the future be stopped short, unless all inference from things gone by to things still to come to go for nothing, we are founded to believe ourselves here, and on quitting this world, on our way only to higher worlds, where the genus man, comprehending all the modifications inanimate and animated, inorganised and organic, vegetable and animal, sentient and intellectual,—from the first and simplest to the last and highest, on which it was founded—No longer divided in petty individuals, some earlier, others later—some here, others there—distinct and separate from each other—fathers parted from their offspring—children severed from their parents,—each individual having views, interests, designs different and disconnected from those of the rest,—shall every where be all united in one single connected individual:—where, by the eternal connexion and concatenation of all things, all that

has happened from the first beginning of time and of space, shall equally by the Almighty be pressed upon our sight, and held up to our eternal contemplation!

CHAPTER XLI.

Is education an advantage to the lower classes?

It has been asked, is it better on this globe to leave the humble, the poor, the lower classes, in their native ignorance, or to educate them, to give them more knowledge? To this I answer: as long as they can be left, while in their native ignorance, to preserve their innocence and their contentment, their lot, perhaps, is more conducive to their happiness than more information: they can be but happy. But in the higher human races a period will come when even the mind of the poor, the humble, the lower classes, will be roused from its torpor; when it will receive a certain developement; when it will seek a certain knowledge; when the higher classes, do what they will, can no longer entirely keep the lower classes under, can no longer prevent them from attaining a certain degree of information; when, if the lower classes are not taught enough to be satisfied with their lot, or only to seek amending it only by laudable means, by industry, by production, by doing good, they will learn enough to be dissatisfied with their situation, to

do evil, to make bad worse, and to render those above them and themselves miserable. In nature, in society, in human affairs, this progress is unavoidable; and it is equally so to find among the individuals that are no longer of the lower and more ignorant classes, nor yet among the higher orders, some, who for their private purposes will in the lower foment this dissatisfaction, and make that discontent tend to the detriment of the higher orders, and to their own ultimate misery. It then becomes the wisdom, the policy of the higher orders, who can no longer stifle the seeds of knowledge in the lower classes, to direct their activity to good only—to give these lower classes sufficient knowledge of the different effects of good and evil, to make them curb their tendency to evil and destruction—to lead them to the superior knowledge that good alone is the general and certain ultimate road to happiness—to counteract that little knowledge that might lead to discontent, to repining at one's lot, and to evil, by that greater knowledge, which leads only to good and to happiness; and where tracts have by enemies of the people been disseminated to render them dissatisfied, and to teach them to repine at what is, to disseminate other counteracting tracts, in order to finish their education, and teach them the means to improve their happiness, by increasing their powers of good and of production.

CHAPTER XLII.

Why should, in a state, individuals have over the measures of other individuals, which are called public measures, and are intended for the good of all, a greater influence, in proportion as they are richer, higher born, and have connexions more numerous and more varied?

Because each individual, in proportion as he already has possessions, rank and situation more extended, more important, more varied, more showing; as already his welfare is connected with that of a wider surrounding base; stands on a higher supporting pinnacle, rests on the prosperity of a more numerous depending population, both from what he already has and must fear to lose, and from what more he may reasonably expect to gain or not to gain, according as the country to which he belongs is well or ill governed—according as its defence, its security, its prosperity, are neglected or are attended to, —both from his fears and his hopes,—must feel a greater repugnance to whatever measure may

tend to have the resources of a larger tract, the means of more numerous inhabitants ill administered, the security and welfare of a greater population sacrificed to those of fewer individuals; because he must feel a greater interest and desire to see over a vaster region and among greater multitudes of men, the general welfare of all more predominate over the private welfare which a few may only attain at the expense of the many: because he must be more conscious that his personal advantage depends upon the prosperity of tracts more extended, of other individuals more numerous and more important; and because each individual, in proportion as he already has possessions, rank, situation more extended, more varied, more thriving—as already his welfare is connected with that of a wider surrounding base, stands on a higher supporting pinnacle, rests on the prosperity of a more numerous population—as he reckons more connexions and more dependants—not only must more apprehend to let views, interests, defence, security, protection and welfare, more contracted, which are only personal to himself, and only are attainable at the expense of those of other individuals, interfere with, and eclipse, and darken, and obscure his view of the general and public welfare of the community at large: he must not only more wish to see his private and personal wel-

fare and prosperity only increased through means of the welfare and the prosperity of the community at large, but must not merely from his possessions, his rank, his situation, but still more from his leisure, his education, his pursuits, his acquirements more numerous, more extended, and more varied, of what may to him, not only as a private individual, but as a member of the commonwealth at large, be most beneficial, have also the means of gaining from regions more extensive, from periods more remote and more general, and from individuals more numerous and varied, information, knowledge, science, more minute, more explicit, calculated to guide the greater power and influence he possesses, to the more extensive, and minute, and certain, and equal production of this public benefit and welfare; because he can better know how, with the smallest personal and individual sacrifices, to produce the greatest public advantages; because a man who has only a small domain, a few acres of ground, a circumscribed pursuit—who only grows, produces, manufactures, or trades in a single or a few articles—who only follows up a single avocation, attends only to a few personal concerns, can neither have the same desire nor employ the same means to prevent that any part of the country should be sacrificed to some other part, the same anxiety

that every part should be alike flourishing—cannot suffer so much, be vulnerable in parts so distant from his person and from each other; cannot feel so anxious that every part alike be well administered; that each bear the public burthens in exact proportion to its capabilities, as he whose possessions are more extended, more varied, more distant from each other; who thus knows better the proportion of what each part individually can bear to lose or to gain by the gain or loss of each other part; because, while the more humble, the more confined to bodily toil and labour, can more plead necessity for their ignorance of the connexion between their private benefit and the public weal, the rich and high can less allege their attention to the former as an excuse for neglecting the latter; and because, if we admit that men in a state of nature, and as isolated individuals, may be governed by mere instinct, or by personal and private views alone, we should not presume that men, after having for the sake of gaining more than they sacrifice, by entering with each other in a social compact, can again of these superior advantages lose sight so completely, should so take leave of all wisdom, all policy, as to sacrifice the public good to their private weal. As long as nature produces on this globe different individuals, and those at different periods, she

cannot produce these as all at the same period equal in faculties of body and of intellect; equal in possessions and in powers. Some must have less, others more sway.

CHAPTER XLIII.

At certain periods in certain states, certain rules and regulations have, by common consent, been considered as right and proper—have been agreed to as laws, privileges, properties, of peculiar individuals and stations, and have been assented to by the remainder of the population; which a change of times and circumstances,—of feelings and opinions,—have at other different periods caused to be by later individuals felt as oppressive and grievous. Should these then, by the heirs and successors of these prior individuals that expressly or tacitly consented to them, on the plea of consistency, of maintenance of ancient chartered rights and privileges, be against those that suffer from them be maintained; or should they be given up: should reforms, by those that then alone remained gainers by these rights, become oppressive to others, gained by, be consented to, or even be proposed?

In a society for common benefit, by common consent established, each man can only be supposed to have expressly agreed to sacrifice certain rights, which nature gave him with regard

to other individuals, in consideration of certain other greater advantages which he obtained from those others, in compensation of those rights given up. No man can, in a society formed for the good of all, be supposed or considered as having expressly consented to granting certain other privileges, to which he was not by nature bound, to his own detriment, and without adequate compensation.

But individuals die and are succeeded by others, and in most countries laws have been established, by which the relations of people that die should, as nearest to them, step into their properties and possessions: should be their heirs. A regulation which is an extension of the law of nature, by which property only belongs to the first occupant. By this regulation, enforced by society, some have stepped into great rights and privileges, and others, coming later, have been debarred from any—have been left destitute. This is no reason why of those who for their own advantage and with their own free-will consented, at a period when they found their own benefit in doing so, to grant others certain privileges, the later descendants, who did not expressly consent to those privileges, should still at later periods, when by their tenor aggrieved, and when with reason wishing them abrogated, in virtue of mere laws of inheritance, framed in opposition to the laws of nature, and depriving

certain individuals born after others of their natural rights, be considered as bound by them; and as having, without their fault, doing, or consent, forfeited their natural claims. The only real reason can be found in the superior might of those that first got possession, and that are determined to keep it; and to leave it to those they like. But even if they had an undoubted and undisputed right, there would after a certain period be a policy in gradually making concessions, since it is dangerous to resist what the majority of the people for good and cogent reasons demand, till the pressure and torrent of public opinion rushes with sufficient strength to break the barriers, and tear open with violence the dykes and sluices, which, by gently and gradually opening, might have let the accumulating waters, without deluge or havoc, gently off, to the equal advantage of all.

CHAPTER XLIV.

Conclusion.

TEN or twelve years ago, when I first published the result of my long sojourn in the east, in the shape of a historic novel, I intended Anastasius to have been immediately followed up by an essay on beauty, taken in the most extensive sense of the word, and embracing alike every species of attribute, physical and intellectual, of which the mere passive contemplation affords, through the channel of the senses, to the mind capable of appreciating them, the exalted pleasures of which the cause is called beauty.

The collecting of the materials required for this disquisition had occupied a great portion of my early life, and I purposed to dedicate my work, when perfected, to her to whom I owe the most exquisite enjoyment of my existence, and in whom I had found the most perfect model of all the qualities of person and of intellect of which I meant to investigate the principles.

Every step, however, which I attempted to take towards the completion of my task, made me feel more fully, how much more extensive

was my undertaking—how much more arduous would be my labours, than I had first anticipated. I found that the first principles of the attribute called beauty lay in the earliest modifications of matter, and that its ultimate and highest effects only showed themselves in the last and noblest faculties of mind. The greatest bliss which we are destined to enjoy in a future world, will probably consist in the tranquil contemplation of all the beauties—all the harmonies —which we then will perceive and be struck with, in the organization and movements of the universe.

The mere preliminaries of my principal aim have thus produced the work which I here submit to the tender mercies of the public. Doubtful, very doubtful, whether I shall be granted time to achieve it, I wish to give the short synopsis of its destined contents, which long and deep meditation on the subject has led me to form.

All sensations of pleasure begin in the external sense, or at least in what we are still, on this globe, agreed to call the external sense, in order to distinguish it, from that assemblage of more internal, and abridged, and undeveloped organs and faculties, which we still distinguish by the name of mind; and of all sensations of pleasure the immediate cause is intrinsically called good; but of all sensations of pleasure the immediate

cause is not yet called beautiful,—or, in the abstract, beauty. There are modifications grateful to the senses of touch, taste, smell, even of hearing and sight, which are good, and which are grateful, but which give not yet a pleasure sufficiently intense and marked to call its cause beautiful. No person sufficiently educated to have a sense of the pleasure derived from beauty would apply the term beautiful to the merits of a soft couch, a dainty viand, even a fine perfume, however grateful these might be to the sense: and the Greeks, who certainly had a very quick sense of the delights derived from beauty, only continued to apply to its attributes the general term of good, or kalos. Later, when more words were introduced, in order to discriminate the finer shades of feeling, by external modifications produced, the modifications of sound and those of sight were, of the modifications immediately affording delight to the external sense, the first and simplest which, when capable of giving very great pleasure, received the distinctive epithet of beautiful. The note of the nightingale was judged beautiful; so was the colour of a carnation, the form of a rose, and the movement of a swan on the glassy pool.

Afterwards again the power of giving pleasure to the senses of hearing and sight received, according to its different degrees, other more partial denominations. Some things, allowed to be

good, but still only capable of giving by their contemplation a pleasure comparatively feeble, will only be called pretty, others will be called handsome, others beautiful, nay others even sublime: and the sort of beauty which is displayed by movements is peculiarly called grace. It is, however, evident, that as the sense, less or more intense, of beauty, must depend upon the susceptibilities of the person beholding its attributes, the same thing will by one person only be allowed to be pretty, which by another person will be called handsome, by another beautiful, and by another even sublime. A clown will perhaps think he honours a fine sunset by calling it pretty, which a man of fine taste will regard as evincing downright sublimity.

Much nonsense has been written about the meaning of the word sublime, and many attributes have been called sublime on very absurd grounds. I know none to which the term is properly applied, except those of which the contemplation gives intense pleasure. I do not say that that pleasure may not be accompanied by a certain degree of awe, or even terror; but in that case the awe, the terror, only accompanies, does not produce, the pleasure; and if carried too far it even extinguishes all feeling of pleasure. Nobody thinks a rack, a gibbet, a hobgoblin sublime, however awful, however terrible; and the servant who follows his master up the

crags of Etna, will from the scene perhaps, with much more intense feelings of terror, derive sensations of the sublimity infinitely feebler than his master. The same thing of which the sublimity will only strike partially when viewed from an insecure spot, in which apprehension for our safety forms a diversion to our finer feelings, will only strike with all its sublimity, when contemplated from where our mind is at liberty to attend secure to all its beauties; and we shall in a forest avert our eyes from the boa constrictor, which in the zoological garden we shall behold with rapture.

I have already, higher up, shown that probably all radiations of sound only have their sensible beginnings within the atmosphere of peculiar planets or worlds; that we cannot discern impressions of sound coming from a further distance than our own peculiar atmosphere; that, consequently, the beauties of sound cannot strike us from a higher, a more extensive, or more distant quarter than the limits of our own globe; but that the radiations of light—those that cause in us the impressions of sight—reach our persons from the furthest heavens.

On the beauties displayed by the modifications of sound, as these have comparatively in space and in time a limited and circumscribed province, I shall not here further expatiate; I

shall confine my researches to the beauties that begin with impressing the sense of sight.

The beauties, discernible in external objects through the sense of sight, may exist in these objects, and not be felt at all, as long as no beholders exist, or even as long as beholders have not the peculiar sentient faculties fit to feel, or to derive pleasure from them. Visible beauties of different sorts and degrees, may find in different entities faculties less or more able to feel them. Some men shall remain entirely indifferent to any beauties of sight whatever: some shall only, of the beauties of sight feel those of mere light, without feeling those of colour, or form, or of movement: others shall feel the beauties of colour—be enraptured over a bed of tulips or hyacinths—and be indifferent to those of the visible forms, which these lights and shades, or these different colours, by their variety, their outline, and their contrast produce: others again shall also feel the beauties of stationary forms; and others, finally, shall be impressed by the successive variations and changes in these forms, which constitute the beauties of movement and grace. Some connoisseurs in painting are in raptures with the beauties of a Rubens, who see not those of a Raphael.

But the beauties of external objects that delight the sense—those that, because the sense is

the judge of them, are called sensible,—are only the most superficial: they come from the shortest distance withoutside the body, and they penetrate to the least distance withinside the mind. There are, in external objects, other beauties, which, though they can, like the former, only through the medium and channel of the organs of sense, make their impression on, and be felt by the intellect, yet go deeper in the mind than the former ones, make, through the organs and faculties of the sense, their impression on the higher organs and faculties of the mind: by their contemplation more evidently produce the pleasure which they afford in the organs and faculties of the mind, and therefore are called, no longer merely sensible, but intellectual.

I say, though they can, like the former, only through the medium and channel of the organs of sense make their impression and be felt; for whatever beauty we may conceive, and however much we may call it intellectual, in view of the organs and faculties on which it produces its chief effect of pleasure, it still, like every thing else that makes an impression on the mind, can only make that impression on the mind, through the medium and channel of the preliminary outposts of that mind, the organs of the external sense.

As in the external sense there are different organs: namely, those of touch, taste, smell,

hearing and sight, each instrumental to and supporting different faculties, so in the mind there also are different faculties, each resting, as I have shown, on different organs, namely, those of recollection, of imagination, of comparison, and of abstraction: and whatever external object is so modified as by its contemplation through the sense to afford any of these different faculties when properly cultivated, an eminent pleasure is said to possess a certain degree of intellectual beauty.

Thus certain things may by their size, others by their durability, others by their physical strength or their mental power, others by their utility, their appropriateness, their ingenuity, of by any other quality, when possessed in so eminent a degree as to cause through its mere contemplation a sensible degree of pleasure, be entitled to the epithet of beautiful.

We enjoy a pleasure in thinking of, we find a beauty in contemplating an ingenious problem, a useful invention, a clever machine, a stupendous structure. We dwell with a feeling of delight on the sight or idea of the pyramids of Egypt, or of the wall of China, though they have no attributes that particularly strike the sense; because the mind is astounded by the thoughts of the ingenuity they have required, or the labour they have cost, or the time they have stood, or the effects they are cal-

culated to produce: for the same reason we talk of the beauty of virtue, of propriety, of modesty, of magnanimity. We call certain actions handsome, beautiful, sublime.

Already productions of mere nature may possess different degrees of beauty sensible and intellectual. Great as are the beauties to the sense, and even to the mind, of a rich ore, a precious gem, a rare mineral, how much are not they exceeded, by those more numerous, of the most trifling organized entity! how superior to the beauties of a mere vegetable again are those of an animal, which to mere movements produced by a pressure from without, adds motions produced by an impulse from within; and above all, how greatly above the highest beauties of a brute rise those of form and of movement of a human being! What a number of subjects for the most delightful contemplation to the faculties both of the sense and the mind, do not the attributes of the latter afford, which do not exist in any of the former!

Nor should I, even among the beauties more inherent, more capable of being felt by all, more lasting, which an object may derive from its permanent attributes, omit those less intrinsic, less stationary, less durable,—more adventitious, —more transient,—more fugitive, which it may derive merely from that rarity, that novelty, calculated for a time to prevent it from palling

upon the sense or the mind, and causing its contemplation transiently to give a double enjoyment. This novelty is what makes us behold with such delight, and find such beauty in an object, while very scarce of its sort: in a gem, a precious stone of unusual size and purity.

But productions of human art may, to the contemplation of man, in his capacity as an entity endowed with faculties of reason, beside beauties sensible and intellectual of the same sort with those offered by productions of nature, offer beauties of another and a different sort, which productions of mere nature cannot display.

Of these latter sort of beauties, only to be seen in productions of human art, the first and foremost is that of imitation.

Nature, whatever she does, is always original. She can repeat herself millions of times; she cannot imitate herself in a single instance: but man may by his art constantly imitate nature. Man may in certain materials, and by a certain process, produce a resemblance to certain effects, which nature has produced by materials or by a process very different; and man may, by the skill and ingenuity displayed in his imitative performance, and by the agreeable occupation it affords to the faculties of comparison and discrimination of the beholder, in discerning the real difference, and in finding out the intended resemblance, cause the contemplation to afford

great pleasure, and the work to offer great beauty to the mind, even where, being the good imitation of an unsightly object, it have nothing in it directly to please the sense. Thus a good imitation of a pigsty, or of a wrinkled old hag, in painting, or that of a ridiculous coxcomb or an antiquated coquette in a drama, may, through the skill the imitation evinces, merely as imitation, have great merit, great power of pleasing, great beauty, though the original itself have none.

And if the good and arduous imitation of an original itself ugly already has powers of pleasing, and attributes of beauty, the good imitation of an original, itself handsome, will have tenfold more beauty and more powers of pleasing, first, because the good imitation of a handsome object, and which has attributes of light, colour, form, and movement very vivid and very definite, is always more difficult, and requires greater attention and skill than that of an ugly object, of which the visible attributes are more arbitrary, less definite; and, secondly, because the imitation moreover of the greater powers of directly pleasing the sense, already possessed by the original, inherits a portion.

Besides imitative beauties which human art can offer, both to the sense and to the mind, human art can, through the sense, but only to the mind, offer descriptive beauties, like those presented by an interesting history, a good tale,

a clever poem, which in that mind give to the faculties of recollection, of imagination, of comparison, of discrimination and of judgment, in the contemplation of them, an easy and a pleasant excitement and occupation.

Of the beauties of imitation, some only address the sense; penetrate not, or only penetrate a little way, in the mind; others through the medium of the sense address the mind more pointedly. Among the former are those which address the ear only—namely, imitations of sounds; and those others which address the eye only—imitations of light, such as a drawing in black and white chalk, or a design in Indian ink, may present; or imitation of colours, such as, in a picture, various pigments may offer; or imitations of forms, such as a model, a carving may display; or imitations of movements—of forms exhibiting, in addition to stationary and permanent modifications, changing situations,—such as may be presented by those moveable puppets called automata; and moreover by real live persons, when of the actions and gestures, in other live persons by internal movements or passions of the mind prompted, they imitate the external display, under the name of mimetic performances.

Of the beauties of imitation, which through the medium of the sense chiefly address the mind, the principal are those which, through the

channel of the ear or the eye—of sound or of sight—imitate the audible or visible expression of the movements or passions of the human mind, in pantomimes, in dialogues, and in dramas.

Having thus stated what in external objects are called beauties, let us reverse the medal, and inquire what in them are called deformities, uglinesses.

People are apt to imagine that the word ugliness, deformity, means the exact converse of the word beauty; that, as whatever is pleasing to the higher senses of hearing and sight is called beautiful, whatever is displeasing to these is called ugly, deformed. This, however, is not exactly the case.

A sound may to a certain degree be pleasing, and be called beautiful; and when carried to a greater pitch, and becoming harsh or loud, piercing or stunning, become displeasing, irksome, painful, and yet for all that not be thought to deserve the epithet of ugly. The pleasing murmur of a gentle stream may become the loud roar of a cataract, and yet not be accused of ugliness.

In the same way a vision, a spectacle, a combination of light, colour, forms, visible movements, may become so multifarious, so rapid in its changes, as to become to the eye that contemplates it fatiguing, irksome, painful, and yet

not be called ugly. The sun, though its light dazzles, is not called ugly.

Visible attributes, addressed to the sense of sight, must have in them a something of which the contemplation, through the medium of the sense, makes some disagreeable impression on certain of the faculties of the very mind—of recollection, of imagination, of comparison, or of reason—before they are called ugly or deformed. The sensation of ugliness or deformity is entirely a sensation of the mind.

This is so true, that certain combinations of lights, of colours, of forms, and of movements, which in marble, or any other material in which they could make no disagreeable impression on the mind, would please the sense extremely—as we see in certain porphyries and breccias, interspersed with vivid spots and veins—shall in certain other substances, as in tainted meat, in which they suggest to the intellect ideas disagreeable and revolting, as of decay and corruption, through the reaction of the intellectual impression, to the very sense appear disgusting, deformed, ugly; and shall induce us to avert the eye from them; as if that eye itself immediately suffered from their sight, instead of only being the instrument and medium through which the mind suffers from their contemplation.

Thus the same colours which, in their right place, and where they denote health and well-

being, by their vividness please, and make us dwell with delight on the contemplation of them—the crimson which on the chubby cheek, the purple which in the meandering veins, the coral which on the pouting lip, charm the sight,—will offend, when that same crimson, in the bottle nose, that same purple, in the angry pimple, that same coral, round the inflamed eyelid, denote ill health or suffering.

Forms most fuscous, most confused, most indistinct, will, in the trunk of a decayed tree, and where they suggest no disagreeable idea, still be thought picturesque, when forms already more distinct, more clear, more symmetrical, combined in a skeleton, will, merely by suggesting the idea of death, exhibit a combination by many deemed exceedingly ugly.

It fares the same with movement. The motions of halting and limping, in themselves and directly to the sense offering nothing offensive, only because, through the sense, they suggest a defect to the mind, through that mind in return react on the sense, present to the sense ugliness and deformity, and are by that sense beheld with pain.

Even in human beings, colours, forms, and movements beautiful to the eye—every attribute of elegance and of grace,—but accompanied by an expression which conveys something sinister to the mind, and leaves on that mind some

disagreeable impression—an oblique cast in the eye, a look of hypocrisy or design—will have their beauty impaired by a certain degree of deformity, of ugliness.

There is a feeling of deformity, of ugliness, of displeasure, which we derive from the contemplation of an external object, in itself indifferent, merely from our expectations concerning that object having been raised too high; merely from our having anticipated in it beauties which we do not find, and which leave us disappointed.

Thus a picture which, if only considered as a sketch, or as a general imitation of human nature, may be thought very pleasing, very well performed, will, on the contrary, if it be considered as a finished performance, or as the imitation of the lineaments of a peculiar person, and be deemed to fail in its resemblance to that peculiar individual, be reckoned very bad, very displeasing, very paltry.

Thus again an expression which in common prose, and uttered off-hand and without pretension, may pass unnoticed, uncensured, when ushered as the effect of premeditation, of study; when introduced in poetry, or in a drama,—when surrounded by a pompous preface or frame—will, from its not answering the expectations raised, appear not only trite, insipid, but bad, positively ugly, deformed. We shall deem that habitation which, as the hovel of a poor man, we look upon

with complacency, when we consider it as the mansion of a king, mean, unworthy, ugly, and offering, with the state of its owner, contrasts and fallings off offensive and disagreeable.

Such is already even here the harmony of the different attributes of nature, that in general as they have more of the requisites of external beauty, they also have more of those of internal goodness. But still, as the nature of this globe is itself far from perfect, there are in it many things, which may be very pleasing to the external sense, when only superficially contemplated; and which nevertheless may on the mind, when their effect penetrates deeper in the same, leave on it a very disagreeable impression—be by it deemed very ugly and deformed. The reverse may also be the case. A human being, ugly and deformed to the sense, may to the mind, by his intellectual qualities, become a sublime object. The same modification may thus, according to the different aspects in which we view it, often either be very handsome or very ugly; and our judgment in that respect must entirely depend upon the attributes which we take as the criterion of beauty or of ugliness.

Still I have said enough to show that beauty, that ugliness are not merely imaginary—not mere creations of the mind; that external objects, according as they are modified, become capable of giving to the sense and the mind of

the beholder a certain degree of pleasure, of which we call the cause beauty, or a certain degree of pain, of which we call the cause deformity; that of external objects the beauty or the ugliness depends on the greater or less correspondence or discord they offer with the organs and faculties of sense and of mind, pointedly called in to contemplate them, and to feel their impressions; and that the word taste,—which in its literal sense is only the faculty of judging of the flavours of external objects; of the degree of pleasure these are able to give to the papillæ of palate—in its figurative sense, in which it judges of the degree of pleasure they are fit to give to the higher senses and the mind, has its rules, as unerring, as little arbitrary as it has in the former sense.

Nor does it prove any thing to the contrary that tastes differ; that one person shall think an object handsome, beautiful, which another person thinks ugly, deformed; as long as the two different persons only judge that object by different criteria. The man may call a woman beautiful, who only judges her by her outward form, and another man may call her ugly, who only judges her by her mind within; and both may be equally right.

It does not even prove any thing to the contrary that people may accustom their figurative, their mental taste, like their bodily taste, to

relish attributes generally thought displeasing; that as some men like tobacco and snuff, which to a pure and uncorrupted taste are offensive and nauseous, some may be brought to like defects, deformities of body or mind—vulgarity, obscenity, and the like. They can only do so by vitiating their natural taste; and for one relish they will thus acquire for what is bad or ugly, they will, by blunting their faculties, lose a hundred finer relishes for what is good and handsome. They will relish the peach and the nectarine less, as they acquire a greater hankering after smoke and tobacco.

Now we find that, in consequence of the peculiar relationship between external objects and man's organization of sense and of intellect, which those objects first formed, and next affect, in proportion as productions of nature and art are first chosen, and are next combined, in such a way as to enable them to cause in each of the different faculties of the sense and of the mind, on which they are calculated by their contemplation to make an impression—in those of the ear and the eye; in those of the memory, the imagination, the comparison, the discrimination and the judgment—an impression more intense and more vivid, still remaining compatible with pleasure, and short of that excess which produces pain; as moreover those productions sensible and intellectual, have more of that variety which

enables the sense and the mind, the instant these faculties begin from the contemplation of any one of them in particular no longer to derive any increasing pleasure, but stand on the brink of deriving from it fatigue, lassitude and pain, without loss of time and space, to pass over to the contemplation of some other modification, which, capable of acting on organs and faculties of sense and mind still fresh, shall still be able to give these a pleasure destitute of pain—as, for instance, from the contemplation of sounds the sense and mind shall be enabled to pass to that of sights; and in sights from that of mere lights to that of various colours; from that of mere colours to that of various forms; from that of forms to that of movements; from attributes which only please the sense to those that please the mind—the faculties of memory, of imagination, of comparison, of discrimination, of reason, of judgment, of reflection—from beauties of nature to beauties of art; from beauties unimitative and undescriptive to beauties imitative and descriptive; and as by each of these different modifications sensible and intellectual remaining, on the one hand, sufficiently distinct and separate from each of the others, to be able separately in its contemplation to occupy the sense and the mind, while it can afford these pleasure uninterfered with, undiverted from, unconfused by the impression of any of the other

remaining modifications, and, on the other hand, sufficiently to be with each of the rest blended in a single greater whole, as, the moment it threatens by its further contemplation to cause fatigue or pain, to allow the sense and mind without difficulty—without a hitch or stoppage —to glide away from it to the contemplation of some other attribute capable of making an impression new and fresh, these productions of nature and art affect the sense and the mind of those, capable by cultivation to understand and to feel their merit, with beauties sensible and intellectual, more intense, more durable, more calculated by their contemplation to fill that sense and that mind with a pleasure more intense and more lasting—less in danger by satiety to pall upon the organs of sense and mind, and to cause in these organs lassitude and a desire of change.

We find that in imitative works where the beauty lies in the pleasure derived from the truth of that imitation, the more attributes the original offers to imitate, and the greater number of these attributes are by art imitated well, the more difficulty, and choice, and genius, there appears in the imitation; and the greater consequently will be the beauty of that imitation.

That thus, though already the most trifling imitation, so produced that the intention of imitating shall be apparent, and shall seem successful,—though already the mere imitation of

the outline of a mountain or a cloud, in black and white, may please,—the good imitation of an organized production will be entitled to please more; that of an animated entity still more; that of a human being still more than that of a mere brute; that of a human form, of which all the component parts are selected with the utmost care and attention, more than that of a human form of which the component attributes are taken indiscriminately; and that of human entities, placed with regard to each other in such connexion, intellectual and bodily, that their minds are seen to react on each other, will be enabled to please intelligent minds more than that of human entities insulated and separate; as long as that connexion can be faithfully represented by the artists, and can be embraced by the beholder.

That thus, though even a mere eye or nose or mouth, an arm, a leg, a bust, in its character as imitation, has a right to please, if, in as far as it goes, and aims at resembling the original, it is faithful and succeeds, a whole figure, imitating also the connexion between the different parts of the body, is calculated to please more; and that, though an imitation in chalk, or in Indian ink, only showing the lights, not the colours of the original, may be very beautiful, an imitation of the local tints of an object is more beautiful.

That though a pantomime imitating the mere

external actions and movements of the human body may be pleasing, a drama, imitating the internal movements and impulses of the human mind, when good, must be a thousand times more pleasing.

That though already a drama—a comedy, or a tragedy—which, in its imitation of the forms and movements of nature and of art, whether of a more vulgar sort or of a more select description, offers great faithfulness, great truth, great variety, great impressiveness, may already in its different component parts, each taken separately, present great individual merits, produce great individual pleasure both to the eye and to the mind of the beholder, even while these different parts still be ill connected together, while they still harmonize so little with each other, that the impression of later scenes again effaces the impression produced by earlier scenes; that each later part does not yet, by its accord, or even by its contrast with a prior part, increase the effect of that prior part, its own, or that of the whole; yet a drama, which, in addition to separate scenes equally faithful, equally true, equally varied, equally impressive with those of the former spectacle, shall moreover, between those scenes be discerned to present that connexion, that relationship, and that harmony, which enables the later scenes to recall the earlier ones, to explain them more clearly, and, by their reference to, and

even contrast with these earlier ones, to render these, and themselves, more impressive, more striking than they would singly, and out of their connexion with what precedes and what follows, have been; and which enables the ultimate winding up of the action to strike with the force of all its former incidents, brought to bear upon, and to be concentrated in a single focus, shall, as a whole, offer beauties and give pleasures still infinitely more intense and striking: and the essential, the leading, the characteristic difference between the system of the English and of the French stage only consists in the English having sacrificed too much of the connexion, of the harmony, and of the effect of the whole, to the prominence of certain minor and partial details; and the French having, on the contrary, in their blind devotion to the rules of the unities,—of which that of action alone is of vital consequence to the interest of the subject, and that of time and of place are of little importance, except in as far as they render the representation more easily intelligible, and leave the mind more at leisure to dwell on its real beauties,—suffered too many of the charms of detail that vivify the mass, and give it truth and animation, to be kept out of sight, and thereby to leave it destitute of chiaro-scuro and of prominence.

Ideal imitation, or ideal beauty, is not that which is destitute of original: of what should

that be the imitation? We are unable to conceive any thing in the mind, that has not been previously offered to the sense; and beauty or even truth cannot exist in art, which has not first been beheld in nature. What is called *ideal* imitation is that imitation of which the different component parts, though in nature found separate from each other, and often in different individuals, have in the mind of the imitator, by his ideas been brought nearer, been more concentrated in one focus, more divested of intervening parts, even imitative, but less interesting than those retained; and have thus, by their approximation and selection, been rendered more striking than generally are the originals of nature. This ideal imitation may be displayed in sculpture, in painting, in the drama, in objects striking the sense, in objects striking the mind—in objects ugly, as well as handsome: but when presented in handsome objects, it is infinitely more pleasing, as well as more difficult, than indiscriminate and unselected imitation.

But while we find that, though the least attribute of an original, well imitated, by presenting success, has a right to please the beholder, the most important feature, ill imitated, and presenting a failure, has an equal right, through the sense, to displease, and present deformity to the mind; and the more, in proportion as the failure is more marked and more striking.

Works of human art, unimitative and imitative, in addition to their more direct beauties and powers of pleasing, may offer other charms in the scarcity or novelty of the material; or in the associations they present with peculiar events or persons: in the capabilities of affording to certain persons connected with these entities or events peculiar pleasures and fascinations, which perhaps they may not possess to the sense or mind of other individuals, or of man in general.

Such, for instance, shall to a fond child offer the lock of hair that belonged to an affectionate parent; to a doting lover offer the riband worn by an adored mistress; to the curious, in general, offer the chair in which Buonaparte meditated on the conquest of the world.

All then that remains is, in our actions, intended by their beauty to strike the beholder, to conform to this experience: in our practice to follow these principles: in our combinations to build on these grounds: in this world—since the pleasures produced by the contemplation of beauty are the highest of which man is susceptible—to produce as much beauty, sensible and intellectual, as we can; and to live in the hopes that when, with this life, the substances more coarse, more confined, and with their beauties still mixing more deformities, that fed it, fall away,—when radiance alone remains and wafts

our spirit to more exalted globes—we shall from a higher and more central point of view, in the tranquil contemplation of the harmonies of worlds innumerable, enjoy a felicity without bounds in time or place.

If, in expectation of this glorious consummation, I meanwhile for a time take leave of my reader, it will only be according to my family motto, which, whatever else may fall away, represents hope as still remaining unimpaired; still pointing to another and a better place.

THE END.

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